



Biological Assessment Study

Little Whitewater Creek Bollinger and Cape Girardeau Counties

2014 - 2015

Prepared for:

**Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch**

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TABLE OF CONTENTS

	Page
1.0 Introduction.....	1
1.1 Study Area/Justification.....	1
1.2 Purpose.....	1
1.3 Objectives	2
1.4 Tasks	3
1.5 Null Hypotheses.....	3
2.0 Methods.....	3
2.1 Study Timing	3
2.2 Station Descriptions	3
2.2.1 Little Whitewater Creek Biological Assessment Sampling Stations.....	4
2.3 MoRAP Aquatic Ecological Classification	4
2.3.1 Ecological Drainage Unit.....	4
2.3.2 Aquatic Ecological Systems	7
2.3.3 Valley Segment Types	8
2.4 Habitat Assessment.....	8
2.5 Biological Assessment.....	8
2.5.1 Macroinvertebrate Collection and Analysis.....	8
2.6 Physicochemical Collection and Analysis.....	9
2.6.1 <i>In situ</i> Water Quality Measurements	9
2.6.2 Water Chemistry	9
2.7 Data Analysis.....	9
2.8 Quality Assurance/Quality Control (QA/QC)	9
2.8.1 Field Meters	9
2.8.2 Biological Samples	10
2.8.3 Biological Data Entry	10
2.8.4 Duplicate Sample Collection	10
3.0 Analyses and Results	10
3.1 Stream Habitat Assessment.....	10
3.2 Macroinvertebrate Biological Assessment	12
3.2.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)	12
3.2.2 Macroinvertebrate Percent and Community Composition	12
3.2.2.1 Fall 2014 Sampling Season.....	12
3.2.2.2 Spring 2015 Sampling Season	17
3.3 Physicochemical Water Data	20
3.3.1 Stream Discharge	20
3.3.2 Nitrate + Nitrite-N	20
3.3.3 Total Nitrogen.....	20
3.3.4 Total Phosphorus	20
3.3.5 Turbidity	21
4.0 Discussion.....	22
4.1 MSCI and Biological Metrics	22
4.2 Water Quality Conditions	23
4.3 Possible Effects of Land Use on Stream Habitat	23

		Page
4.4	1999-2000 Macroinvertebrate Samples	23
5.0	Conclusions.....	23
6.0	References Cited	24

TABLES

Table 1	Riffle/Pool Ozark/Upper St. Francis/Castor EDU Perennial/Wadeable Biological Criteria, Biological Support Categories, and Macroinvertebrate Stream Condition Index (MSCI) Scores for Previously Collected Macroinvertebrate Samples at the Little Whitewater Biological Criteria Reference Station	2
Table 2	Percent Land Cover from MoRAP Thematic Mapper Satellite Data from 2000 to 2004	7
Table 3	Physical Characteristics of the Sampling Reaches for Little Whitewater Creek Based on Values from the MoRAP Valley Segment Types (VST) Geographic Information Systems (GIS) Layer and Other GIS Sources	8
Table 4	Predominant Category Habitat Values, Category Habitat Scores, Total Habitat Scores, and Percent of Reference SHAPP Values from Stream Habitat Assessments for Little Whitewater Creek Test Stations and the Castor River Biological Criteria Reference Station.....	11
Table 5	Fall 2014 and Spring 2015 Riffle/Pool Ozark/Upper St. Francis/Castor EDU Stream Biological Criteria, Biological Support Categories, Biological Metric Values and Scores shown in Parentheses, and Macroinvertebrate Stream Condition Index (MSCI) Scores for the Little Whitewater Creek Sampling Stations.....	13
Table 6	Biological Metric Values for Sensitive Taxa and EPTT Metrics at the Biological Criteria Reference Samples and the Little Whitewater Creek Test Stations, Fall 2014.....	14
Table 7	Percent Dominant Macroinvertebrate Families and Taxa at the Little Whitewater Creek Test Stations, and the Ozark/St. Francis/Castor EDU Biological Criteria Reference Samples, Fall 2014	16
Table 8	Biological Metric Values for Sensitive Taxa and EPTT Metrics at the Biological Criteria Reference Samples and the Little Whitewater Creek Test Stations, Spring 2015.	18
Table 9	Percent Dominant Macroinvertebrate Families and Taxa at the Little Whitewater Creek Test Stations, and the Ozark/Upper St. Francis/Castor	

		Page
	EDU Biological Criteria Reference Samples, Spring 2015.....	19
Table 10	Physicochemical Variables for Surface Water Samples at the Little Whitewater Creek Bioassessment Study Sampling Stations, Fall 2014.....	21
Table 11	Physicochemical Variables for Surface Water Samples at the Little Whitewater Creek Bioassessment Study Sampling Stations, Spring 2015.....	22

FIGURES

Figure 1	Map of Little Whitewater Creek and Sampling Stations	5
Figure 2	Land Use of the Little Whitewater Creek Watershed	6
Figure 3	Percent of Taxa by Biotic Index Range, Fall 2014.....	14
Figure 4	Percent of Taxa by Biotic Index Range, Spring 2015	17

ATTACHMENTS

Appendix A	Little Whitewater Creek Bioassessment Study Macroinvertebrate Bench Sheets
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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Little Whitewater Creek in Bollinger and Cape Girardeau counties, Missouri. A 24.2 mile segment of Little Whitewater Creek was added to the 2012 and 2014 303(d) list because the “protection of warm water aquatic life” beneficial use designation as specified in the Missouri Water Quality Standards (MDNR 2014e) was not being met based on low Macroinvertebrate Stream Condition Index (**MSCI**) scores. The 303(d) listing was based on macroinvertebrate samples collected in 1999 and 2000, with the source of impairment listed as “unknown.” A 4.75 mile segment of Little Whitewater Creek is also listed in the water quality standards (MDNR 2014e) as a biological reference stream segment for the Ozark/Upper St. Francis/Castor Ecological Drainage Unit (**EDU**). The 1999 and 2000 samples were collected within this reference reach.

1.1 Study Area/Justification

Little Whitewater Creek originates in western Bollinger County near the town of Patton and flows southeast toward the town of Millersville in western Cape Girardeau County where it discharges into the Whitewater River (Figure 1). Little Whitewater Creek is listed in the Missouri Water Quality Standards (MDNR 2014e) as a class “P” stream for a distance of 24.2 miles upstream from its confluence with the Whitewater River. Designated uses for Little Whitewater Creek are “warm water aquatic life protection, human health/fish consumption, livestock and wildlife watering, and class A whole body contact recreation.” Little Whitewater Creek is located within the Eastern Ozark Border ecoregion, which is a transitional zone between the St. Francis Knobs and Basins ecoregion to the west and the River Hills ecoregion to the east (Chapman et al. 2002). The Eastern Ozark Border ecoregion is defined by moderately dissected hills and bluffs with soils that are thin and rocky on steeper slopes and areas of claypan and loess in more level areas. Natural vegetation is a mix of oak forest, savanna, glades, and prairies. This ecoregion has a higher percentage of land that has been cleared for cropland than other adjacent Ozark ecoregions.

Prior to this present study, macroinvertebrates were sampled within the Little Whitewater Creek biological criteria reference reach during two different time periods. All of the Little Whitewater Creek macroinvertebrate samples collected in 1999 and 2000 had MSCI scores in the partially supporting category (MSCI score <16), but 3 of 4 samples collected from 2011 through 2013 had MSCI scores in the fully supporting range (Table 1).

1.2 Purpose

The purpose of this study was to determine if the Little Whitewater Creek macroinvertebrate community indicates that the protection of aquatic life beneficial use, as specified in the Missouri Water Quality Standards (MDNR 2014e), is being met. If MSCI scores indicate that this designation is not met, possible sources that might be affecting the macroinvertebrate community were to be determined. Macroinvertebrate and water samples were collected, and stream habitat assessments and land use analysis were conducted to determine the health of the macroinvertebrate community and the condition of the watershed.

1.3 Objectives

- 1) Determine if the macroinvertebrate community in Little Whitewater Creek indicates that the protection of aquatic life beneficial use designation as specified in the Missouri Water Quality Standards is being met by comparing to data collected from biological criteria reference streams in the Ozark/Upper St. Francis/Castor EDU.
- 2) Determine if the water quality in Little Whitewater Creek is meeting the Missouri Water Quality Standards and U.S. EPA recommended levels for nutrients.
- 3) Assess the stream habitat quality of Little Whitewater Creek.

Table 1
 Riffle/Pool Ozark/Upper St. Francis/Castor EDU Perennial/Wadeable Biological Criteria,
 Biological Support Categories, and Macroinvertebrate Stream Condition Index (MSCI)
 Scores for Previously Collected Macroinvertebrate Samples at the Little Whitewater
 Biological Criteria Reference Station

Station	Sample Year	Sample No.	TR	EPTT	BI	SDI	MSCI	Support
Fall Sampling Season								
Little Whitewater Creek #5	1999	994532	87 (5)	21 (3)	6.3 (3)	3.36 (3)	14	P
	2000	0010171	75 (3)	19 (3)	6.0 (3)	3.23 (3)	12	P
	2011	110976	100 (5)	26 (5)	5.6 (5)	3.64 (5)	20	F
	2012	120069	85 (3)	22 (3)	6.1 (3)	3.61 (5)	14	P
Metric Score=5	If		>86	>23	<5.9	>3.36	20-16	Full
Metric Score=3	If		86-43	23-11	5.9-7.9	3.36-1.68	14-10	Partial
Metric Score=1	If		<43	<11	>7.9	<1.68	8-4	Non
Spring Sampling Season								
Little Whitewater Creek #5	1999	994504	95 (3)	24 (3)	6.3 (3)	2.90 (3)	12	P
	2000	0010148	97 (5)	27 (3)	6.0 (3)	3.33 (3)	14	P
	2012	120043	108 (5)	35 (5)	4.8 (5)	3.65 (5)	20	F
	2013	131946	110 (5)	34 (5)	6.3 (3)	3.66 (5)	18	F
Metric Score=5	If		>95	>29	<5.9	>3.61	20-16	Full
Metric Score=3	If		95-47	29-15	5.9-7.9	3.61-1.81	14-10	Partial
Metric Score=1	If		<47	<15	>7.9	<1.81	8-4	Non

1.4 Tasks

- 1) Conduct a bioassessment of the Little Whitewater Creek macroinvertebrate community at five sampling stations during the fall 2014 and spring 2015 sample seasons.
- 2) Conduct a water quality assessment of the Little Whitewater Creek sampling stations.
- 3) Conduct a stream habitat assessment to ensure comparability of aquatic habitats of Little Whitewater Creek sampling stations to reference conditions.

1.5 Null Hypotheses

- 1) The macroinvertebrate community will not differ among longitudinally separate reaches of Little Whitewater Creek.
- 2) The macroinvertebrate assemblages in the Little Whitewater Creek samples will be similar to the Ozark/Upper St. Francis/Castor EDU Wadeable/Perennial stream biological criteria.
- 3) Physicochemical water quality of Little Whitewater Creek will meet the Water Quality Standards (**WQS**) of Missouri (MDNR 2014e).
- 4) Physicochemical water quality will not differ among longitudinally separate reaches of Little Whitewater Creek.
- 5) Stream habitat at Little Whitewater Creek will be comparable to the Castor River Ozark/Upper St. Francis/Castor EDU Biological Criteria Reference Station.
- 6) Stream habitat will not differ among longitudinally separate reaches of Little Whitewater Creek.

2.0 Methods

Carl Wakefield, Mike Irwin, and Raissa Espejo of the Missouri Department of Natural Resources, Division of Environmental Quality, Environmental Services Program, Water Quality Monitoring Section conducted this study.

2.1 Study Timing

Macroinvertebrate and water samples were collected at the Little Whitewater Creek sampling stations during the fall 2014 and spring 2015 sampling seasons. Fall sampling was conducted on September 15-17, 2014, and spring sampling was conducted on March 23-24, 2015.

2.2 Station Descriptions

The study area and sampling locations for the Little Whitewater Creek biological assessment study are shown in Figures 1 and 2. A total of five Little Whitewater Creek test stations were surveyed for this study.

2.2.1 Little Whitewater Creek Biological Assessment Sampling Stations

Little Whitewater Creek #1 – Cape Girardeau County: Legal description is SW 1/4, Sec. 20, T. 32 N., R. 11 E. Geographic coordinates are UTM zone 16, 0778365.8 Easting, 4147849.8 Northing. Sampling station located upstream of County Road 352.

Little Whitewater Creek #2 – Bollinger County: Legal description is SW ¼ Sec. 23, T. 32 N., R. 10 E. Geographic coordinates are UTM zone 16, 0773579.9 Easting, 4147373.8 Northing. Sampling station located upstream of Highway B.

Little Whitewater Creek #3 – Bollinger County: Legal description is NE ¼ Sec. 16, T. 32 N., R. 10 E. Geographic coordinates are UTM zone 16, 0770953.5 Easting, 4150197.6 Northing. Sampling station is located upstream of County Road 356.

Little Whitewater Creek #4 – Bollinger County: Legal description is SW ¼, Sec. 5, T. 32 N., R. 10 E. Geographic coordinates are UTM zone 16, 0768248.6 Easting, 4152277.2 Northing. Sampling station located downstream of County Road 366.

Little Whitewater Creek #5 – Bollinger County, MO: Legal description is NE 1/2 Sec. 1, T. 32 N., R. 09 E. Geographic coordinates are UTM zone 16, 0765440 Easting, 4153745 Northing. Sampling station is located upstream of County Road 360.

2.3 MoRAP Aquatic Ecological Classification

The aquatic ecological classification developed by the MoRAP is a classification system that divides the aquatic resources of Missouri into distinct regions. It has seven levels of classification starting at large regions and then dividing them into smaller sub-regions (Sowa et al. 2004). The following are the seven levels of classification in hierarchical order: zone, subzone, region, aquatic sub-regions, EDU, Aquatic Ecological Systems (AES), and Valley Segment Types (VST). The levels of classification are based on biology, zoogeography, taxonomic composition, geology, soils, and groundwater connection. Some levels of the hierarchical system use geology and soils to classify, whereas other levels use biology and taxonomic composition of aquatic communities. EDU, AES, and VST are the three levels of classification that will be assessed in detail for this study.

2.3.1 Ecological Drainage Unit

The EDU is level five of the classification hierarchy and is based on geographical variation of the taxonomic composition of the level four sub-regions. An EDU is a region in which aquatic biological communities and habitat conditions can be expected to be similar. Land cover percentages for the Missouri portion of the Ozark/Upper St. Francis/Castor EDU and the Little Whitewater Creek test stations are shown in Figure 2 and Table 2. Land cover data were derived from the MoRAP Thematic Mapper satellite data from 2000 to 2004. Land use among Little Whitewater Creek test stations was similar for percent cropland, much higher for percent grassland, and much lower for percent forest than the values for the entire Ozark/Upper St. Francis/Castor EDU. Within the Little Whitewater Creek watershed, there was a trend of slightly increasing percentages for cropland and grassland and a decreasing percentage for forest moving from the most upstream station to the most downstream station.

Figure 1
Map of Little Whitewater Creek and Sampling Stations

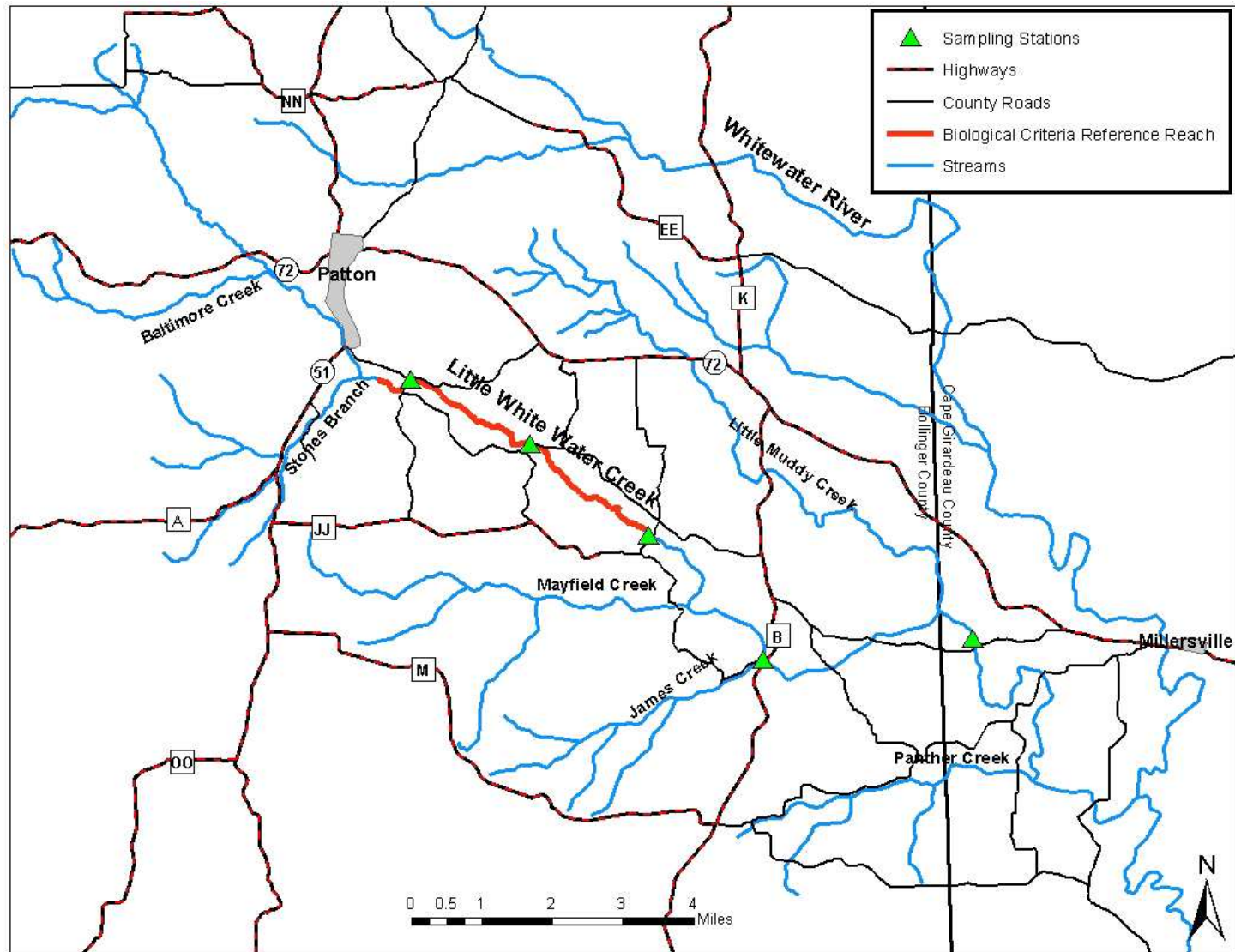


Figure 2
Land Use of the Little Whitewater Creek Watershed

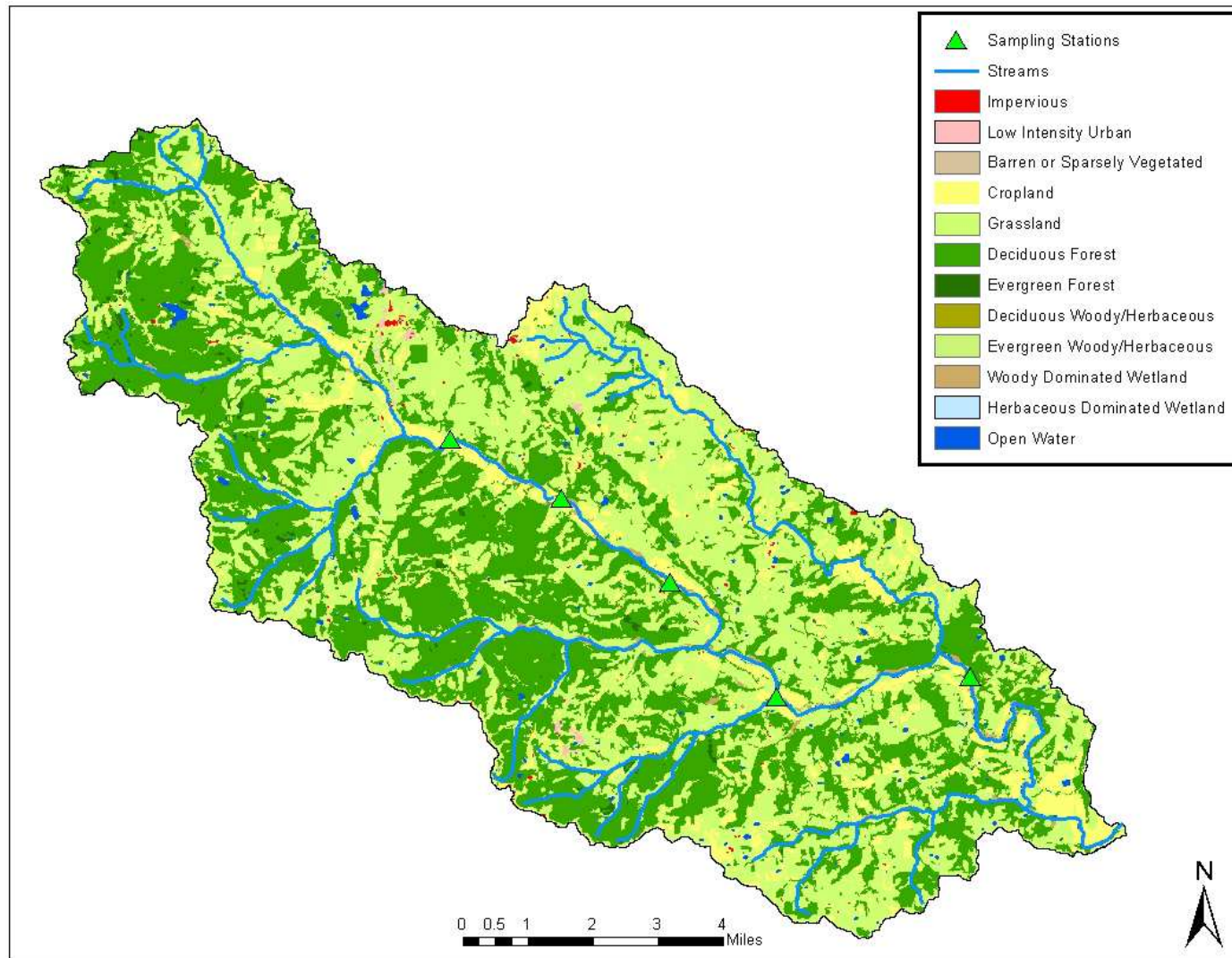


Table 2
 Percent Land Cover from MoRAP Thematic Mapper Satellite Data from 2000 to 2004

Land Cover	Ozark/Upper St. Francis/Castor EDU	Little Whitewater Creek #1	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Impervious	0.7	0.2	0.2	0.2	0.2	0.2
High Intensity Urban	<0.01	--	--	--	--	--
Low Intensity Urban	1.0	0.2	0.2	0.2	0.2	0.3
Barren/Sparsely Vegetated	0.3	0.02	0.03	0.02	0.02	0.03
Cropland	8.1	8.6	7.2	7.8	7.6	7.5
Grassland	23.2	45.2	40.9	42.5	42.5	41.4
Deciduous Forest	58.2	43.0	48.6	46.2	46.5	47.3
Evergreen Forest	1.5	0.7	0.9	1.0	1.1	1.3
Deciduous Woody/Herbaceous	3.7	0.03	0.03	0.02	0.02	0.02
Evergreen Woody/Herbaceous	0.03	0.03	0.04	0.04	0.04	0.04
Woody Dominated Wetland	1.4	0.9	1.0	0.9	0.8	0.7
Herbaceous-Dominated Wetland	0.1	0.02	0.02	0.01	0.01	0.01
Open Water	1.9	1.1	1.0	1.1	1.0	1.1

2.3.2 Aquatic Ecological Systems

Aquatic Ecological Systems are level six of the classification hierarchy. They classify aquatic systems based on geology, soils, landform, and groundwater influence. Little Whitewater Creek is located in the Boeuf Creek AES type (Sowa and Diamond 2006). Local relief for the Boeuf Creek AES type is variable and ranges from nearly 50 to 200 feet. Bedrock geology is dominated by Ordovician Jefferson City-Cotter formation cherty dolomites, although sandstone and limestone are occasionally present. There are some sinkholes, but they are not common in most areas of the AES type. Surface soil textures consist of silty loams or occasionally cherty soils and tend to have slow to moderate infiltration rates. Streams like Little Whitewater Creek that drain to the great rivers (Mississippi and Missouri rivers) consist of headwaters and creeks and the lower end of larger rivers. Spring influence is variable and is not as characteristic as other Ozark AES types. Historic vegetation consisted of oak savanna, woodlands, and smaller amounts of prairie and glades.

2.3.3 Valley Segment Types

Valley Segment Types are level seven of the classification hierarchy. Stream segments in the GIS stream network layer are classified using a 5-digit code. The 5-digit VST code is based on temperature regime, stream size, flow regime, geology, and relative gradient. The 5-digit VST codes and the values for the five parameters making up the codes can be found in Table 3.

Table 3

Physical Characteristics of the Sampling Reaches for Little Whitewater Creek Based on Values from the MoRAP Valley Segment Types (VST) Geographic Information Systems (GIS) Layer and Other GIS Sources

	Little Whitewater Creek #1	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Watershed Area (mi ²)	79.3	52.1	38.5	25.4	27.1
Strahler Order	4	4	4	4	4
Link Magnitude	58	39	32	28	22
VST 5 Digit Code	23122	22121	22121	22121	22141
Temperature Regime	Warm	Warm	Warm	Warm	Warm
Stream Size	Small River	Creek	Creek	Creek	Creek
Flow Regime	Permanent	Permanent	Permanent	Permanent	Permanent
Geology	Limestone	Limestone	Limestone	Limestone	Sandstone
Relative Gradient	Medium	Low	Low	Low	Low

2.4 Habitat Assessment

A standardized assessment procedure was followed as described for Riffle/Pool Habitat in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2010e). Habitat assessments were conducted at the five Little Whitewater Creek test stations and the Castor River biological criteria reference station on September 15-17, 2014.

2.5 Biological Assessment

Biological assessments consisted of macroinvertebrate collection and physicochemical sampling for the two sample periods.

2.5.1 Macroinvertebrate Collection and Analysis

A standardized macroinvertebrate sample collection and analysis procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2012a) for riffle/pool (**RP**) streams. Three standard habitats— flowing water over coarse substrate (**CS**), depositional substrate in non-flowing water (**NF**), and rootmat (**RM**)—were collected at the sampling stations.

Macroinvertebrate data were analyzed using two methods. The first analysis was to calculate the Macroinvertebrate Stream Condition Index (**MSCI**) using the four general biological metrics found in the SMSBPP (MDNR 2002, MDNR 2012a). These four biological metrics included:

1) Taxa Richness (**TR**); 2) Ephemeroptera/Plecoptera/Trichoptera Taxa (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These individual metrics were scored by comparing them to the biological criteria for perennial/wadeable streams from the Ozark/Upper St. Francis/Castor EDU and combined to form the Macroinvertebrate Stream Condition Index (**MSCI**). MSCI scores of 16-20 qualify as fully supporting, 10-14 are partially supporting, and 4-8 are considered non-supporting of the protection of warm water aquatic life beneficial use designation as specified in the Missouri Water Quality Standards (MDNR 2014e).

The second analysis was an evaluation of macroinvertebrate community composition using percent composition of EPTT, sensitive taxa, and dominant macroinvertebrate families and taxa. Comparisons of the macroinvertebrate community of Little Whitewater Creek and the biological criteria reference streams also were made.

2.6 Physicochemical Data Collection and Analysis

2.6.1 *In situ* Water Quality Measurements

During each sampling period, *in situ* water quality measurements were collected at each of the bioassessment sampling stations. Field measurements included water temperature (°C) (MDNR 2010b), dissolved oxygen (mg/L) (MDNR 2012c), conductivity (µS/cm) (MDNR 2010c), and pH (MDNR 2012b).

2.6.2 Water Chemistry

Surface water grab samples were collected and returned for analyses to ESP's Water Quality and Chemical Analysis Sections. Turbidity (NTU) (MDNR 2010a) was measured and recorded in the ESP WQMS biology laboratory. Water samples were analyzed by ESP's Chemical Analysis Section for total suspended solids, chloride, sulfate, total calcium, total magnesium, total phosphorus, ammonia-N, nitrate+nitrite-N, and total nitrogen. Procedures outlined in *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* [Standard Operating Procedure (**SOP**) MDNR-ESP-001 (MDNR 2014a)] and *Field Sheet and Chain-of-Custody Record* [SOP MDNR-ESP-002 (MDNR 2014b)] were followed when collecting water quality samples. Stream velocity was measured at each station using a SonTek/YSI FlowTracker Handheld-ADV (Acoustic Doppler Velocimeter). Discharge was calculated per the methods in SOP MDNR-ESP-113, *Flow Measurement in Open Channels* (MDNR 2013).

2.7 Data Analysis

Physicochemical data were examined by analyte to determine whether stations had violations of the Missouri WQS. Sampling stations that had values not in compliance with the WQS or recommend U.S. Environmental Protection Agency (U.S. EPA) recommended reference values will be discussed with possible influences being identified.

2.8 Quality Assurance/Quality Control (QA/QC)

2.8.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with the Standard Operating Procedure MDNR-ESP-213, *Quality Control Procedures for Checking Water Quality Field Instruments* (MDNR 2010d).

2.8.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the SMSBPP document (MDNR 2012a). Macroinvertebrates found in samples were identified to the taxonomic levels found in Standard Operating Procedure MDNR-ESP-209, *Taxonomic Levels for Macroinvertebrate Identification* (MDNR 2014c).

2.8.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with the Standard Operating Procedure MDNR-ESP-214, *Quality Control Procedures for Data Processing* (MDNR 2014d).

2.8.4 Duplicate Sample Collection

Duplicate samples are collected at two randomly selected sampling stations per season for macroinvertebrates and for 10 percent of water samples. Duplicate macroinvertebrate and water samples were collected at test station #2 during the fall 2014 sampling season and test station #1 during the spring 2015 sampling season.

3.0 Analyses and Results

3.1 Stream Habitat Assessment

Table 4 provides habitat assessment scores for the Little Whitewater Creek test stations and the Castor River biological criteria reference station. Stream habitat data were collected on September 15-17, 2014 with Carl Wakefield and Raissa Espejo conducting the assessment. SHAPP guidance states that test stations scoring at least 75 percent of the total score of reference station should support a similar biological community. Because the Little Whitewater Creek stream habitat assessment scores were ≥ 75 percent of the reference scores, test stations should be capable of supporting a similar macroinvertebrate community.

Many of the Little Whitewater Creek habitat metrics scores were either in the optimal or suboptimal range indicating good habitat quality. However some metrics did not score as well at the Little Whitewater Creek test stations. These metrics included epifaunal substrate, channel flow status, riffle quality, and vegetative protection for both banks. Sediment deposition was elevated at stations #1 and #2. Right bank stability of station #1 and riparian zone width for both banks of station #5 scored in the marginal or poor category. Compared to the Castor River SHAPP, Little Whitewater Creek had lower epifaunal substrate and riffle quality values at all stations and higher values for sediment deposition at stations #1 and #2.

Table 4

Predominant Category Habitat Values, Category Habitat Scores, Total Habitat Scores, and Percent of Reference SHAPP Values from Stream Habitat Assessments for Little Whitewater Creek Test Stations and the Castor River Biological Criteria Reference Station

Stream Habitat Parameters	Little Whitewater Creek #1	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5	Castor River #1
Macroinvertebrate Sample Number	14936	14934	14933	14932	14931	--
Stream Habitat Assessment Date	09/17/2014	09/16/2014	09/16/2014	09/16/2014	09/15/2014	09/17/2014
Epifaunal Substrate/Available Cover	II (11)	III (10)	III (10)	III (10)	II (13)	I (17)
Embeddedness	I (17)	I (18)	I (16)	I (16)	I (16)	I (16)
Velocity/Depth Regime	II (15)	II (15)	II (15)	I (16)	II (13)	II (11)
Sediment Deposition	IV (5)	III (7)	II (14)	II (12)	II (13)	II (13)
Channel Flow Status	III (9)	II (12)	III (9)	III (8)	III (7)	III (10)
Channel Alteration	I (20)	I (20)	I (20)	I (20)	I (18)	I (20)
Riffle Quality	III (10)	III (10)	III (8)	III (10)	III (10)	II (11)
Bank Stability – Left Bank	I (9)	I (10)	II (8)	II (8)	I (10)	I (10)
Bank Stability – Right Bank	III (5)	II (6)	I (10)	I (10)	I (10)	I (10)
Vegetative Protection – Left Bank	IV (1)	IV (2)	IV (2)	IV (2)	III (4)	III (3)
Vegetative Protection – Right Bank	IV (2)	IV (2)	III (4)	IV (3)	IV (2)	IV (2)
Riparian Zone Width – Left Bank	I (10)	I (10)	I (9)	I (10)	IV (2)	I (10)
Riparian Zone Width – Right Bank	I (9)	I (9)	I (10)	I (10)	III (7)	I (9)
Total Habitat Score	123	131	135	135	125	142
Percent of Reference SHAPP	86.6	92.3	95.1	95.1	88.0	--

Habitat parameter categories range from I to IV with category I = optimal, category II = suboptimal, category III = marginal, and category IV = poor. Habitat parameter scores are listed in parentheses and range from 0 to 20 except for vegetative protection and riparian zone categories, which range from 0 to 10.

3.2 Macroinvertebrate Biological Assessment

3.2.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

MSCI scores were calculated for Little Whitewater Creek test stations using riffle/pool perennial/wadeable biological criteria for the Ozark/Upper St. Francis/Castor EDU (Table 5). All of the Little Whitewater Creek MSCI scores were in the fully supporting range during both sampling seasons. MSCI scores ranged from 16 to 20 during the fall 2014 sampling season. During spring 2015, all samples had MSCI scores of 20 except the Little Whitewater Creek #1b duplicate sample, which had a score of 18.

Most Little Whitewater biological metrics were in the fully supporting range (metric score of 5) during both sampling seasons. Metrics that were below the fully supporting threshold during the fall 2014 sampling season were TR at station #5, BI at station #1, and SDI at stations #1-#3. All of the spring 2015 metric values were in the fully supporting range except SDI in the duplicate sample for Little Whitewater Creek #1b.

3.2.2 Macroinvertebrate Percent and Community Composition

The percent composition of sensitive taxa, EPTT, and the five dominant macroinvertebrate families and taxa at each station are presented in Tables 5-8 and Figures 3 and 4. Values in bold type represent the five dominant macroinvertebrate families and taxa for each station.

3.2.2.1 Fall 2014 Sampling Season

Percent Composition of Sensitive Taxa

Compared to the biological criteria reference data, most of the Little Whitewater Creek samples had a higher percentage of taxa in the moderately tolerant biotic index range (BI = 5.0-7.4) and a lower percentage of taxa with biotic index values <5.0 (Table 6 and Figure 3). The only exception was Little Whitewater Creek #5, which had a slightly higher percentage of taxa in the moderately tolerant range and a similar percentage of taxa with biotic index values <5.0. All of the Little Whitewater Creek samples had fairly similar values for taxa in the tolerant range (BI = 7.5-8.9), and most of the stations had slightly lower values for the very tolerant range (BI >8.9) compared to reference conditions.

Table 5

Fall 2014 and Spring 2015 Riffle/Pool Ozark/ Upper St. Francis/Castor EDU Stream Biological Criteria, Biological Support Categories, Biological Metric Values and Scores shown in Parentheses, and Macroinvertebrate Stream Condition Index (MSCI) Scores for the Little Whitewater Creek Sampling Stations

Station	Sample No.	TR	EPTT	BI	SDI	MSCI	Support
Fall 2014 Sampling Season							
Little Whitewater Creek #1	14936	88 (5)	28 (5)	6.0 (3)	3.17 (3)	16	F
Little Whitewater Creek #2a	14934	88 (5)	27 (5)	5.8 (5)	3.28 (3)	18	F
Little Whitewater Creek #2b	14935	97 (5)	29 (5)	5.8 (5)	3.36 (3)	18	F
Little Whitewater Creek #3	14933	107 (5)	30 (5)	5.8 (5)	3.36 (3)	18	F
Little Whitewater Creek #4	14932	107 (5)	27 (5)	5.8 (5)	3.46 (5)	20	F
Little Whitewater Creek #5	14931	81 (3)	25 (5)	5.6 (5)	3.45 (5)	18	F
Metric Score=5	If	>86	>23	<5.9	>3.36	20-16	Full
Metric Score=3	If	86-43	23-11	5.9-7.9	3.36-1.68	14-10	Partial
Metric Score=1	If	<43	<11	>7.9	<1.68	8-4	Non
Spring 2015 Sampling Season							
Little Whitewater Creek #1a	15098	105 (5)	34 (5)	5.1 (5)	3.62 (5)	20	F
Little Whitewater Creek #1b	15099	103 (5)	30 (5)	5.4 (5)	3.59 (3)	18	F
Little Whitewater Creek #2	15100	122 (5)	41 (5)	5.7 (5)	3.77 (5)	20	F
Little Whitewater Creek #3	15101	116 (5)	35 (5)	5.8 (5)	3.79 (5)	20	F
Little Whitewater Creek #4	15102	114 (5)	32 (5)	5.5 (5)	3.97 (5)	20	F
Little Whitewater Creek #5	15103	106 (5)	34 (5)	5.2 (5)	3.79 (5)	20	F
Metric Score=5	If	>95	>29	<5.9	>3.61	20-16	Full
Metric Score=3	If	95-47	29-15	5.9-7.9	3.61-1.81	14-10	Partial
Metric Score=1	If	<47	<15	>7.9	<1.81	8-4	Non

Figure 3
 Percent of Taxa by Biotic Index Range, Fall 2014

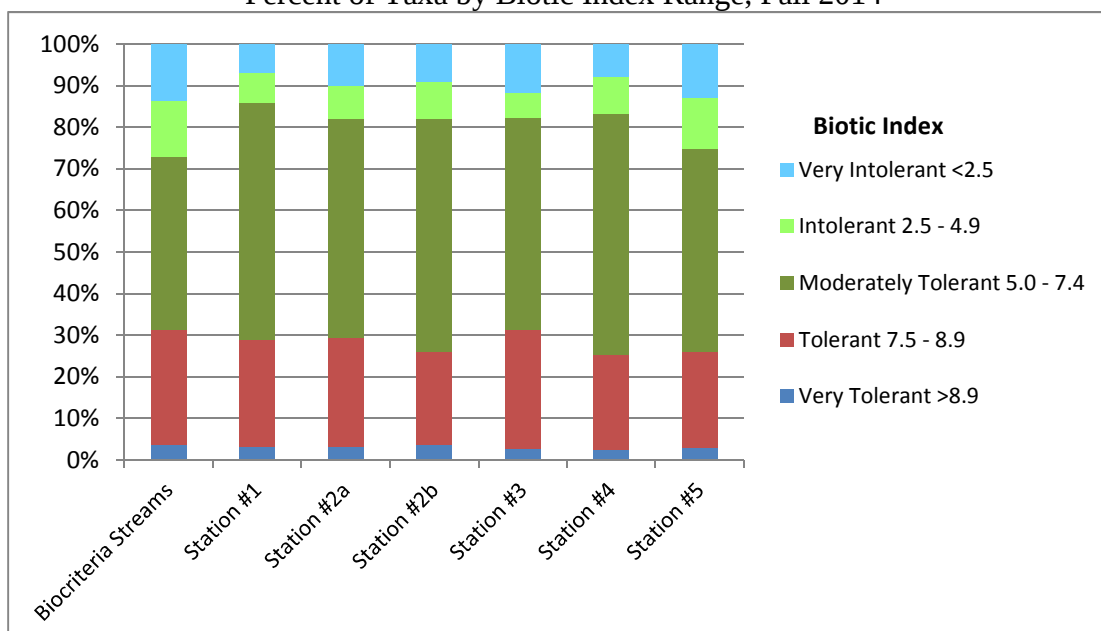


Table 6
 Biological Metric Values for Sensitive Taxa and EPTT Metrics at the Biological Criteria Reference Samples and the Little Whitewater Creek Test Stations, Fall 2014

Variable-Station	Biocriteria Reference Data	Little Whitewater Creek #1	Little Whitewater Creek #2a	Little Whitewater Creek #2b	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Sample Number		14936	14934	14935	14933	14932	14931
Sensitive Taxa							
% BI >8.9	3.6	3.2	3.2	3.6	2.7	2.4	2.9
% BI 7.5-8.9	27.8	25.7	26.1	22.5	28.4	23.1	23.3
% BI 5.0-7.4	41.4	56.9	52.9	55.9	51.1	57.8	48.6
% BI 2.5-4.9	13.7	7.3	7.8	9.1	6.1	8.9	12.5
% BI <2.5	13.5	6.9	10.0	9.0	11.6	7.9	12.8
EPTT Metrics (%)							
EPTT	45.4	58.0	57.5	51.1	56.9	51.2	50.6
Ephemeroptera	37.0	49.8	50.2	44.2	48.5	39.4	35.7
Plecoptera	1.4	0.2	1.8	1.1	1.1	1.9	1.2
Trichoptera	7.1	8.0	5.5	5.8	7.3	9.9	13.7

Biocriteria stream data values are average percent ($n = 11$).

Macroinvertebrate Community Composition

During the fall 2014 sampling season, percent EPTT and percent Ephemeroptera were higher at all test stations except Little Whitewater Creek #5 compared to biological criteria reference data (Table 6). Percent Plecoptera values among test stations were similar to reference conditions except station #1. Percent Trichoptera at test stations ranged from a little lower to a little higher compared to reference conditions.

Little Whitewater Creek test stations had macroinvertebrate communities that generally had a taxonomic composition that was similar to the biological criteria reference streams, and many of the dominant taxa were common to Little Whitewater Creek and reference streams (Table 7). All of the test stations and the biological criteria reference streams had high abundances of chironomids, caenid mayflies, and elmids. Most caenid mayflies were *Caenis anceps* and *C. latipennis*, and most of the elmids were made of *Stenelmis*. Heptageniid mayflies were abundant at most of the test stations, but they were not as abundant in reference stream samples. The primary difference in taxonomic composition between test stations and reference conditions was the much higher abundance of the leptohyphid mayfly *Tricorythodes* at most test stations. The only exception was at station #5, which had only a slightly higher abundance of *Tricorythodes* than reference conditions. The only other primary difference between reference conditions and the test stations was the higher abundance of the amphipod *Hyaella azteca* in the reference streams. Other differences in taxa composition were the higher abundance of water mites (Acarina) at stations #2-#4, chironomid taxa *Tanytarsus* and *Paratanytarsus* at station #1, and baetid mayfly *Baetis* and hydropsychid caddisfly *Cheumatopsyche* at station #5 compared to the other test stations and reference conditions. Most of the dominant taxa among test stations and the reference streams had BI values in the moderately tolerant range (BI = 5.0-7.4) or the lower end of the tolerant range (BI = 7.5-8.9).

Table 7
 Percent Dominant Macroinvertebrate Families and Taxa at the Little Whitewater Creek Test Stations, and the Ozark/Upper St. Francis/Castor EDU Biological Criteria Reference Samples, Fall 2014

Variable-Station	Biotic Index	Biocriteria Reference Streams	Little Whitewater Creek #1	Little Whitewater Creek #2a	Little Whitewater Creek #2b	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Sample Number			14936	14934	14935	14933	14932	14931
Percent Dominant Families								
Chironomidae		20.9	24.5	17.9	15.6	12.7	21.6	14.9
Caenidae		15.4	12.6	18.2	15.9	18.2	13.6	11.7
Elmidae		13.1	4.1	8.1	13.2	12.5	12.3	17.7
Heptageniidae		9.7	3.3	4.5	5.0	4.8	2.2	6.8
Hyalellidae		6.0	2.6	2.0	1.4	0.9	1.5	4.6
Leptohyphidae		4.8	27.9	24.4	20.4	21.3	21.0	6.8
Coenagrionidae		2.7	4.9	2.7	2.5	3.8	1.1	2.7
Arachnida		2.4	1.5	3.1	3.6	3.9	4.3	1.1
Baetidae		2.7	2.5	0.5	0.3	1.1	1.2	7.7
Percent Dominant Taxa								
<i>Stenelmis</i>	5.4	7.3	1.6	4.5	7.6	8.7	4.3	12.2
<i>Caenis latipennis</i>	7.6	6.8	3.5	3.6	2.4	9.1	2.2	0.6
<i>Caenis anceps</i>	7.6	6.4	9.1	14.6	13.5	9.1	11.4	11.1
<i>Hyalella azteca</i>	7.9	6.0	2.6	2.0	1.4	0.9	1.5	4.6
<i>Tricorythodes</i>	5.4	4.8	27.9	24.4	20.4	21.3	21.0	6.8
<i>Tanytarsus</i>	6.7	3.7	7.6	2.6	2.1	1.6	3.2	0.7
<i>Paratanytarsus</i>	7.7	1.1	4.3	2.3	1.8	1.3	2.6	1.4
Acarina	5.7	2.4	1.6	3.6	3.7	3.9	4.3	1.1
<i>Corbicula</i>	6.3	0.3	0.3	1.8	2.9	0.9	--	--
<i>Dubiraphia</i>	6.4	2.4	1.8	2.0	2.2	2.0	4.0	1.5
<i>Baetis</i>	6.0	1.7	1.7	0.3	0.1	0.4	1.1	7.2
<i>Cheumatopsyche</i>	6.6	2.3	2.0	0.2	0.7	1.4	2.1	5.8

Biocriteria reference stream data values are average percent ($n = 11$).

Values in bold type represent the five dominant macroinvertebrate taxa for each station.

3.2.2.2 Spring 2015 Sampling Season

Percent Composition of Sensitive Taxa

The majority of Little Whitewater and biological criteria reference samples were in the moderately tolerant biotic index range (BI = 5.0-7.4) (Figure 4 and Table 8). The percent of taxa in the moderately tolerant range was lower than the biological criteria reference streams at stations #1 and #5, but the remaining stations had a higher percent in this range. Little Whitewater Creek samples generally had a higher percentage of taxa in the very intolerant (BI >2.5) and the very tolerant (BI >8.9) biotic index ranges compared to biological criteria reference streams. For taxa in the intolerant range (BI = 2.5-4.9), all but station #1 had percentages that were lower than reference conditions. Except for one of the duplicate samples at test station #1 (#1a), Little Whitewater Creek samples had taxa in the tolerant range in similar percentages to reference conditions.

Figure 4
 Percent of Taxa by Biotic Index Range, Spring 2015

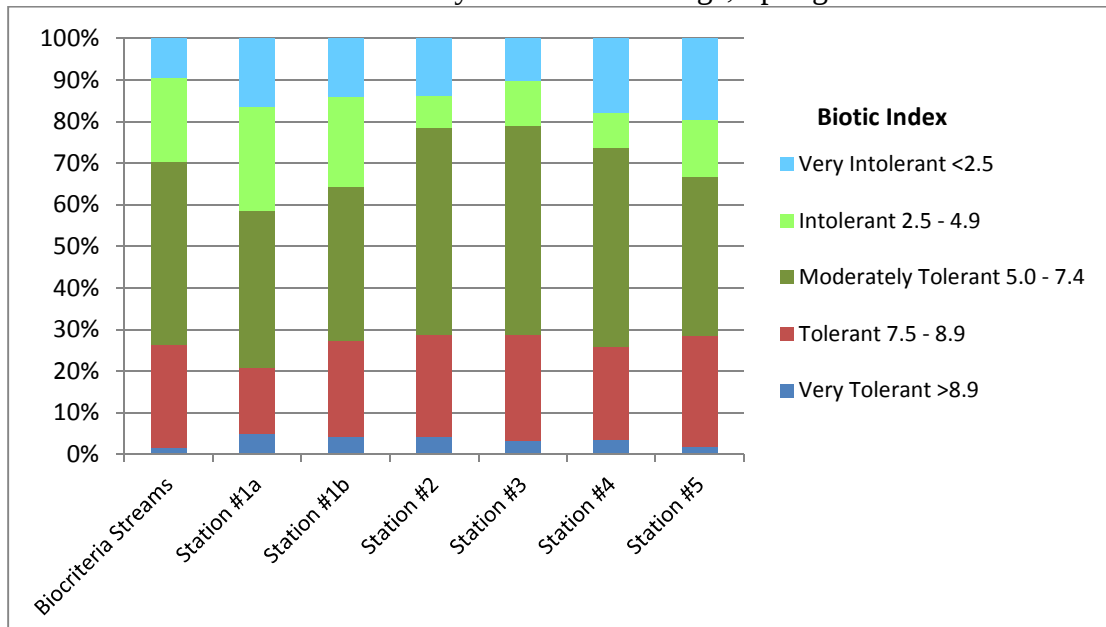


Table 8
 Biological Metric Values for Sensitive Taxa and EPTT Metrics at the Biological Criteria
 Reference Samples and the Little Whitewater Creek Test Stations, Spring 2015

Variable-Station	Biocriteria Reference Data	Little Whitewater Creek #1a	Little Whitewater Creek #1b	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Sample Number		15098	15099	15100	15101	15102	15103
Sensitive Taxa							
% BI >8.9	1.7	5.0	4.1	4.3	3.2	3.5	1.9
% BI 7.5-8.9	24.6	15.8	23.3	24.4	25.5	22.4	26.6
% BI 5.0-7.4	44.1	37.7	36.9	50.0	50.3	48.0	38.3
% BI 2.5-4.9	20.3	25.0	21.8	7.6	11.0	8.3	13.5
% BI <2.5	9.4	16.5	14.0	13.8	10.1	17.9	19.7
EPTT Metrics (%)							
EPTT	40.0	44.4	45.5	39.5	37.3	36.8	59.5
Ephemeroptera	27.7	24.5	28.0	27.2	26.2	22.2	40.2
Plecoptera	3.4	12.9	10.8	5.1	5.8	10.3	7.1
Trichoptera	9.0	7.0	6.8	7.2	5.3	4.3	12.1

Biocriteria stream data values are average percent ($n = 14$).

Macroinvertebrate Community Composition

During the spring 2015 sampling season, percent EPTT and percent Ephemeroptera ranged from slightly lower to slightly higher than biological criteria reference data at all test stations except station #5 (Table 9). At station #5, percent EPTT, percent Ephemeroptera, and percent Trichoptera were higher than the other test stations and reference conditions. Percent Plecoptera values were higher at all Little Whitewater stations compared to biological criteria reference data. Percent Trichoptera values were lower at stations #3 and #4, similar at stations #1 and #2, and higher at station #5.

Many of the Little Whitewater Creek dominant macroinvertebrate families also were common among biological criteria reference streams. Chironomids, caenid mayflies, heptageniid mayflies, and riffle beetles were common in both the test stations and in the reference data. The only macroinvertebrate family that was more common in the biological criteria reference streams was the black fly family Simuliidae. Compared to reference conditions, percent Chironomidae ranged from much lower to slightly lower in the test stations. *Cricotopus/Orthocladius* was the most common chironomid taxa found at most test stations. The only exception was that *Paratanytarsus* was slightly more abundant at station #3 than other chironomid taxa. *Cricotopus/Orthocladius* was also common in the biological criteria reference streams, and the chironomid *Tanytarsus* was more abundant in the reference data than the test stations. Caenid mayfly abundance was made up of both *Caenis anceps* and *C. latipennis*, with *C. latipennis* being more common at most test stations. The most common heptageniid mayflies in test stations were generally *Maccaffertium pulchellum*, *M. mediopunctatum*, and *Stenonema femoratum*, but *M. bednariki* also was found at the test stations. Riffle beetles were primarily made up of *Stenelmis* in Little Whitewater Creek. Some macroinvertebrate families and taxa were more common in the test stations than the biological criteria reference streams. The crane fly *Hexatoma* was more abundant at test station #1 than reference streams. The perlodid stonefly *Isoperla*, the leptohyphid mayfly *Tricorythodes*, and arachnid water mites were more

Table 9
 Percent Dominant Macroinvertebrate Families and Taxa at the Little Whitewater Creek Test Stations, and the Ozark/Upper St. Francis/Castor EDU Biological Criteria Reference Samples, Spring 2015

Variable-Station	Biotic Index	Biocriteria Reference Streams	Little Whitewater Creek #1a	Little Whitewater Creek #1b	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Sample Number			15098	15099	15100	15101	15102	15103
Percent Dominant Families								
Chironomidae		39.2	21.7	22.9	36.9	25.6	35.4	18.6
Caenidae		12.3	10.6	16.0	12.5	12.7	8.4	12.9
Heptageniidae		7.9	4.9	4.5	6.3	4.3	7.2	14.0
Elmidae		7.4	7.9	5.8	6.3	5.9	9.8	5.8
Simuliidae		3.7	2.7	1.5	0.4	0.5	0.8	1.0
Tipulidae		0.5	11.8	10.5	0.5	1.5	0.4	0.2
Perlodidae		0.5	8.2	6.0	2.2	1.5	4.6	2.4
Leptohyphidae		1.1	6.7	5.7	5.6	6.9	3.6	5.7
Arachnida		1.9	3.3	4.5	5.5	8.1	5.6	4.1
Percent Dominant Taxa								
<i>Cricotopus/Orthocladius</i> grp.	6.5	8.7	3.3	5.1	5.5	5.7	5.8	3.4
<i>Caenis latipennis</i>	7.6	7.0	8.0	13.5	12.5	7.0	4.4	6.2
<i>Stenelmis</i>	5.4	4.7	7.5	4.7	5.1	4.1	5.6	4.4
<i>Tanytarsus</i>	6.7	4.4	1.5	1.0	2.9	3.2	3.4	0.4
<i>Caenis anceps</i>	7.6	3.4	2.6	2.5	--	5.7	4.0	6.7
<i>Hexatoma</i>	4.7	0.4	11.6	10.2	0.5	1.5	0.2	0.1
<i>Isoperla</i>	2.0	0.5	8.2	6.0	2.2	1.5	4.6	2.4
<i>Tricorythodes</i>	5.4	1.1	6.7	5.7	5.6	6.9	3.6	5.7
Acarina	5.7	1.9	3.3	4.5	5.5	8.1	5.6	4.1
<i>Sympotthastia</i>	5.7	1.3	1.6	1.1	5.3	1.5	2.8	1.0
<i>Paratanytarsus</i>	7.7	1.7	2.2	3.3	3.9	6.6	3.9	1.3
<i>Stenonema femoratum</i>	7.5	3.1	0.7	0.8	2.5	1.1	3.4	6.2
<i>Maccaffertium pulchellum</i>	3.0	1.7	1.6	1.5	0.8	0.4	1.4	5.3

Biocriteria reference stream data values are average percent ($n = 14$).

Values in bold type represent the five dominant macroinvertebrate taxa for each station.

abundant at all Little Whitewater sites compared to reference streams. Most of the dominant taxa among the test stations and the reference streams had BI values in the moderately tolerant range (BI = 5.0-7.4) or the lower end of the tolerant range (BI = 7.5-8.9).

3.3 Physicochemical Water Data

Water samples and field measurements were collected during the fall 2014 and spring 2015 macroinvertebrate sampling periods (Tables 10 and 11). The results showed that most of the nutrient parameters were below U.S. EPA Nutrient Criteria recommended reference values for the Level III Ozark Highlands ecoregion (U.S. EPA 2000) during the fall 2014 sampling season, but nitrate + nitrite-N and total nitrogen were above recommended reference values in spring 2015. Physicochemical results are arranged to demonstrate trends of certain variables that may suggest a source of effects at the Little Whitewater Creek test stations. Results shown in the following sections are for stream discharge, nitrate + nitrite-N, total nitrogen, total phosphorus, and turbidity by season.

3.3.1 Stream Discharge

Discharge ranged from 2.9 cfs at station #5 to 8.1 cfs at station #1 at Little Whitewater Creek test stations during the fall 2014 sampling season (Table 10). Discharge was higher during the spring 2015 sampling season, ranging from 20.3 cfs at station #5 to 59.0 cfs at station #1 (Table 11).

3.3.2 Nitrate + Nitrite-N

All Little Whitewater Creek samples had nitrate + nitrite-N concentrations below the U.S. EPA recommended reference value (0.24 mg/L) (U.S. EPA 2000) during the fall 2014 sampling season. Nitrate + nitrite-N at Little Whitewater Creek ranged from 0.02 mg/L at station #2 to 0.09 mg/L at station #5 (Table 10).

Nitrate + nitrite-N concentrations were higher than the U.S. EPA recommended reference value during the spring 2015 sampling season at Little Whitewater Creek, ranging from 0.62 mg/L at station #5 to 0.90 mg/L at station #3 (Table 11).

3.3.3 Total Nitrogen

Total nitrogen concentrations were below the U.S. EPA recommended reference value (0.29 mg/L) (U.S. EPA 2000) during the fall 2014 sampling season for all Little Whitewater Creek samples. Total nitrogen ranged from 0.10 mg/L at station #2 to 0.26 mg/L at station #5 (Table 10).

Total nitrogen concentrations were higher than the U.S. EPA recommended reference value during the spring 2015 sampling season (Table 11). Total nitrogen at Little Whitewater Creek ranged from 0.76 mg/L at station #2 to 0.94 mg/L at station #3.

3.3.4 Total Phosphorus

With the exception of the station #1 fall 2014 sample, all total phosphorous values were below the laboratory detectable limit of 0.01 mg/L during both sampling seasons (Tables 10 and 11). The U.S. EPA total phosphorus recommended reference value for the Level III Ozark Highlands

ecoregion (U.S. EPA 2000) is 0.007 mg/L. Because the detection limit is higher than the recommend reference value, it is unknown whether any of the sites other than station #1 (0.013 mg/L) were above the recommended reference values during the fall 2014 sampling season.

3.3.5 Turbidity

Half of the fall 2014 Little Whitewater Creek turbidity concentrations were higher than the U.S. EPA recommended reference value of 1.43 NTU for turbidity (U.S. EPA 2000). Turbidity ranged from <1 NTU at station #5 to 3.17 at station #1 (Table 10).

Turbidity was higher than the U.S. EPA recommended reference value at all of the test stations during the spring 2015 sampling season. Turbidity ranged from 1.53 NTU at station #2 to 3.22 NTU for one of the duplicate samples (#1a) at station #1 (Table 11).

Table 10
 Physicochemical Variables for Surface Water Samples at the Little Whitewater Creek
 Bioassessment Study Sampling Stations, Fall 2014

	Little Whitewater Creek #1	Little Whitewater Creek #2a	Little Whitewater Creek #2b	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Invertebrate Sample Number	14936	14934	14935	14933	14932	14931
Physicochemical Sample Number	1411947	1411945	1411946	1411944	1411943	1411942
Sample Date	09/17/2014	09/16/2014	09/16/2014	09/16/2014	09/15/2014	09/15/2014
Sample Time	0830	1335	1340	1100	1555	1305
Ammonia	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a
Chloride	4.09 ^b	4.80 ^b	4.99 ^b	5.11	5.39	5.84
Sulfate	6.29	6.43	6.71	5.94	6.78	6.82
Total Recoverable Calcium	43.4	38.6	38.7	39.8	39.8	40.1
Total Recoverable Magnesium	25.5	23.9	23.9	23.4	23.7	24.2
Hardness as CaCO ₃	213	195	195	196	197	200
Dissolved Oxygen	7.77	8.96	8.91	9.74	11.06	11.49
Discharge (cfs)	8.07	6.50	6.33	4.12	2.91	2.90
pH (Units)	8.0	8.3	8.3	8.3	8.0	8.4
Conductivity (µmhos/cm)	359	355	354	363	363	352
Temperature (°C)	18.2	21.7	21.7	20.1	21.9	20.6
Turbidity (NTU)	3.17	1.45	1.05	1.36	2.03	<1.00
Total Suspended Solids	<5 ^a	<5 ^a	<5 ^a	<5 ^a	<5 ^a	<5 ^a
Nitrate + Nitrite	0.05	0.02	0.02	0.04	0.05	0.09
Total Nitrogen	0.13 ^b	0.10 ^b	0.10 ^b	0.11 ^b	0.13 ^b	0.26
Total Phosphorus	0.013^b	<0.01 ^a	<0.01 ^a	<0.01 ^a	<0.01 ^a	<0.01 ^a

^a Below detectable limits

^b Estimated value, detected below Practical Quantitation Limit

Units mg/L unless otherwise noted. Values in bold exceed Missouri Water Quality Standards or are elevated compared to U.S. EPA recommended reference condition values.

Table 11
 Physicochemical Variables for Surface Water Samples at the Little Whitewater Creek
 Bioassessment Study Sampling Stations, Spring 2015

	Little Whitewater Creek #1a	Little Whitewater Creek #1b	Little Whitewater Creek #2	Little Whitewater Creek #3	Little Whitewater Creek #4	Little Whitewater Creek #5
Invertebrate Sample Number	15098	15099	15100	15101	15102	15103
Physicochemical Sample Number	151834	151835	151836	151837	151838	151839
Sample Date	03/23/2015	03/23/2015	03/23/2015	03/24/2015	03/24/2015	03/24/2015
Sample Time	1235	1240	1510	0845	1015	1145
Ammonia	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a	<0.03 ^a
Chloride	4.55 ^b	4.47 ^b	4.25 ^b	4.59 ^b	4.65 ^b	4.84 ^b
Sulfate	9.21	9.36	8.89	10.8	9.12	8.67
Total Recoverable Calcium	30.6	30.9	29.3	29.7	29.2	27.7
Total Recoverable Magnesium	16.5	16.6	15.9	16.1	16.0	15.0
Hardness as CaCO ₃	144	146	139	140	139	131
Dissolved Oxygen	11.32	11.30	12.84	10.77	11.12	12.25
Discharge (cfs)	58.95	--	39.11	27.44	23.22	20.33
pH (Units)	7.4	7.4	8.2	7.3	8.2	8.1
Conductivity (µmhos/cm)	264	265	252	259	260	244
Temperature (°C)	13.4	13.4	15.4	10.7	10.1	9.4
Turbidity (NTU)	3.22	1.82	1.53	2.26	1.73	2.10
Total Suspended Solids	<5 ^{ac}	<5 ^{ac}	<5 ^{ac}	<5 ^a	<5 ^a	<5 ^a
Nitrate + Nitrite	0.85	0.85	0.70	0.90	0.76	0.62
Total Nitrogen	0.93	0.90	0.76	0.94	0.81	0.78
Total Phosphorus	<0.01 ^a	<0.01 ^a	<0.01 ^a	<0.01 ^a	<0.01 ^a	<0.01 ^a

^a Below detectable limits

^b Estimated value, detected below Practical Quantitation Limit

^c Exceeded holding time

Units mg/L unless otherwise noted. Values in bold exceed Missouri Water Quality Standards or are elevated compared to U.S. EPA recommended reference condition values

4.0 Discussion

The discussion describes possible effects of water quality, land use, and stream habitat on MSCI and the biological metrics.

4.1 MSCI and Biological Metrics

The MSCI scores from this study and from samples collected from 2011-2013 were much higher than those collected in 1999 and 2000. Only one of the 16 samples collected since 2011 was in the partially supporting range (Tables 1 and 5). For this study, all samples except the fall 2014 station #1 sample had MSCI scores of either 18 or 20. Most of the biological metrics for the current study performed well compared to the biological criteria. The only metric that consistently scored in the partially supporting range was SDI during the fall 2014 sampling season (four of six samples). The TR and EPTT biological metrics both indicated higher diversity, especially during the spring 2015 sampling season. EPTT made up a fairly high proportion of samples during both sampling seasons, ranging from about 51 to 58 percent during the fall 2014 sampling season and from about 37 to 60 percent during the spring 2015 sampling season (Tables 6 and 8). Compared to biological criteria data, percent Plecoptera was especially high during the spring 2015 sampling season at test stations, ranging from about 5 to 13 percent.

4.2 Water Quality Conditions

Water quality results from the fall 2014 sampling season did not show elevated levels for most parameters. Turbidity was slightly elevated at stations #1, #2a, and #4, and the station #1 total phosphorus concentration was higher than the U.S. EPA recommended reference value (Table 10). During the spring 2015 sampling season, the only water quality parameters that were elevated at all of the test stations included turbidity, nitrate + nitrite-N, and total nitrogen (Table 11). Although nitrogen values were about three times higher than the U.S. EPA recommended reference values during the spring 2015 sampling season for all test stations, it did not seem to have much effect on the macroinvertebrate community.

4.3 Possible Effects of Land Use on Stream Habitat

Little Whitewater Creek test stations had much higher percent grassland and much lower percent forest land use than the Ozark/Upper St. Francis/Castor EDU as a whole (Table 2). Within the Little Whitewater Creek watershed, there was a trend of slightly increasing percentages for cropland and grassland and a decreasing percentage for forest moving from the most upstream station to the most downstream station. Stream habitat assessments conducted in fall 2014 also showed that epifaunal substrate and riffle quality had lower values for all test stations, and sediment deposition was higher at the two most downstream test stations compared to the Castor River biological criteria reference station (Table 4). It is unknown what the stream habitat conditions were in 1999 and 2000, but land use in the watershed likely affects substrate quality in Little Whitewater Creek.

4.4 1999-2000 Macroinvertebrate Samples

Little Whitewater Creek was placed on the 2012 and 2014 303(d) list because of low macroinvertebrate MSCI scores from four samples collected in 1999 and 2000 (Table 1). Causes for the low MSCI scores in 1999 and 2000 are not clear since there are no major point sources within the watershed and the water quality results collected for those samples did not indicate any obvious problems. The only notable water quality parameters that possibly might have affected the MSCI scores were very low discharge values for the fall 2009 (0.9 cfs) and fall 2010 (0.8 cfs) and slightly elevated nutrient levels compared to the U.S. EPA recommended reference values (U.S. EPA 2000) for some samples. As mentioned in the previous section, land use and stream habitat also could have affected macroinvertebrate samples, but stream habitat conditions were not documented because habitat assessments were not conducted for these samples.

5.0 Conclusions

The Little Whitewater Creek MSCI scores indicated that the stream was meeting the designated use of aquatic life protection since all of the scores were in the fully supporting range. The biological metrics making up the MSCI indicated that Little Whitewater Creek had a healthy and diverse macroinvertebrate community. No major water quality problems were observed based on water samples in this study. Causes for the lower MSCI scores from samples collected in 1999 and 2000 are unknown, but MSCI results from samples collected from 2011 to 2015 have been in the fully supporting range, with the exception of the fall 2012 station #5 sample.

Tests of the null hypotheses resulted in the following conclusions.

- 1) The macroinvertebrate community will not differ among longitudinally separate reaches of Little Whitewater Creek. This hypothesis was accepted since all Little Whitewater Creek test stations had MSCI scores that scored in the fully supporting range using Ozark/Upper St. Francis/Castor EDU biological criteria during both sample seasons. In addition, many of the dominant taxa were found at all of the Little Whitewater test stations, and percent EPTT was similar for most of the test stations during both sampling seasons.
- 2) The macroinvertebrate assemblages in the Little Whitewater Creek samples will be similar to the Ozark/Upper St. Francis/Castor EDU wadeable/perennial stream biological criteria. This hypothesis was accepted since the Little Whitewater Creek test stations had MSCI scores that scored in the fully supporting range compared to the Ozark/Upper St. Francis/Castor EDU biological criteria.
- 3) Physicochemical water quality of Little Whitewater Creek will meet the WQS of Missouri (MDNR 2014e). This hypothesis was accepted since no water quality standards were violated.
- 4) Physicochemical water quality will not differ among longitudinally separate reaches of Little Whitewater Creek. This hypothesis was accepted since the water quality results were similar among the test stations.
- 5) Stream habitat at Little Whitewater Creek will be comparable to the Castor River Ozark/Upper St. Francis/Castor EDU Biological Criteria Reference Station. This hypothesis was accepted since all of the Little Whitewater Creek stream habitat assessment scores were ≥ 75 percent of the Castor River habitat score.
- 6) Stream habitat will not differ among longitudinally separate reaches of Little Whitewater Creek. Although there were some differences in individual stream habitat metrics, this hypothesis was accepted since all of the stream habitat assessment scores were similar (87 to 95 percent of reference SHAPP).

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Appendix A

Macroinvertebrate Bench Sheets for Little Whitewater Creek

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14936], Station #1, Sample Date: 9/17/2014 8:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	9	7	7
AMPHIPODA			
Hyaella azteca		1	37
BASOMMATOPHORA			
Ancylidae		1	1
Helisoma	1		
Menetus			2
COLEOPTERA			
Berosus			13
Dubiraphia			26
Helichus lithophilus			1
Microcylloepus pusillus	5		7
Psephenus herricki	4	1	
Scirtidae			2
Stenelmis	14		9
DECAPODA			
Orconectes luteus	-99		-99
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		9	8
Ceratopogoninae	1	7	1
Chironomus		1	
Cladopelma		1	
Cladotanytarsus		2	1
Corynoneura		3	
Cricotopus/Orthocladius	1	1	17
Cryptochironomus	2		
Cryptotendipes		6	1
Dicrotendipes	1	19	5
Dixella			2
Hemerodromia	2		
Hexatoma	5	-99	
Labrundinia		1	20
Nanocladius	3	2	1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14936], Station #1, Sample Date: 9/17/2014 8:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Nilotanypus	1		
Parachironomus			2
Paralauterborniella		1	
Parametriocnemus	2		
Paratanytarsus		12	52
Phaenopsectra		2	
Polypedilum flavum	27		
Polypedilum illinoense grp			2
Polypedilum scalaenum grp		2	
Procladius		1	
Pseudochironomus		1	1
Rheotanytarsus	23		
Simulium	1		
Stempellina		1	
Stempellinella	1	5	
Stictochironomus		1	
Tabanus	1	1	
Tanytarsus	1	102	10
Thienemanniella	1	1	
Thienemannimyia grp.	3	1	3
EPHEMEROPTERA			
Acerpenna	2		1
Baetis	25		
Caenis anceps	83	46	6
Caenis latipennis	6	28	18
Callibaetis			3
Choroterpes		8	
Ephemera simulans		-99	
Ephemerellidae	3		
Hexagenia limbata			2
Isonychia bicolor	19		
Leptophlebiidae		20	
Leucrocuta	1		
Maccaffertium mediopunctatum	22		
Maccaffertium pulchellum	19		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14936], Station #1, Sample Date: 9/17/2014 8:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procloeon		6	
Stenonema femoratum		7	
Tricorythodes	379	9	26
LUMBRICINA			
Lumbricina		1	
MEGALOPTERA			
Corydalus	5		
ODONATA			
Argia		3	40
Basiaeschna janata			-99
Enallagma			29
Gomphus		-99	1
Hetaerina			1
Macromia			-99
PLECOPTERA			
Neoperla	3		
TRICHOPTERA			
Cheumatopsyche	30		
Chimarra	33		
Glossosomatidae	9		
Helicopsyche	3		
Hydroptila		1	
Marilia			1
Nectopsyche diarina		2	
Oecetis	5		2
Polycentropus		1	1
Triaenodes			30
TUBIFICIDA			
Enchytraeidae	2		
Tubificidae		4	
VENEROIDA			
Corbicula	2	3	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14935], Station #2b, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	25	4	16
AMPHIPODA			
Hyaella azteca		1	16
BASOMMATOPHORA			
Ancylidae	16	4	12
Helisoma			2
Menetus			1
Physella			1
BRANCHIOBDELLIDA			
Branchiobdellida			2
COLEOPTERA			
Berosus		1	
Dubiraphia		20	7
Ectopria nervosa		3	1
Helichus lithophilus			1
Macronychus glabratus			11
Microcylloepus pusillus	2	2	27
Psephenus herricki	16	1	
Scirtidae			1
Stenelmis	24	68	2
DECAPODA			
Orconectes luteus	-99		
Orconectes punctimanus			2
DIPTERA			
Ablabesmyia		20	5
Ceratopogoninae		2	1
Chironomus			1
Cladotanytarsus		3	1
Clinotanypus			1
Corynoneura			3
Cricotopus/Orthocladius	9		10
Cryptochironomus		1	
Cryptotendipes		1	
Culex			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14935], Station #2b, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Dicrotendipes		10	
Dixella			1
Forcipomyiinae	1		1
Hemerodromia	4		1
Hexatoma	4	1	
Labrundinia		2	16
Natarsia		1	
Nilothauma		1	
Parachironomus			1
Paratanytarsus		6	16
Phaenopsectra		2	
Polypedilum flavum	13		
Polypedilum illinoense grp		1	3
Polypedilum scalaenum grp			2
Pseudochironomus		1	3
Rheotanytarsus	18		1
Stempellinella		5	
Stenochironomus		2	1
Stictochironomus		1	
Tabanus	-99		
Tanytarsus	4	15	7
Thienemannimyia grp.	2	2	2
EPHEMEROPTERA			
Anthopotamus		1	
Apobaetis		1	
Baetis	1		
Baetisca lacustris	1		
Caenis anceps	67	80	20
Caenis latipennis		13	16
Centroptilum		2	
Choroterpes		18	1
Ephemera simulans		-99	
Heptageniidae	29	3	
Hexagenia limbata		2	
Isonychia bicolor	9		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14935], Station #2b, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Leucrocuta	1		
Maccaffertium bednariki	4		
Maccaffertium mediopunctatum	17		
Maccaffertium pulchellum	2		1
Stenonema femoratum		5	
Tricorythodes	244	6	2
LUMBRICINA			
Lumbricina	4	1	1
MEGALOPTERA			
Corydalus	4		
Sialis		-99	
NEOTAENIOGLOSSA			
Hydrobiidae			1
ODONATA			
Argia		6	4
Basiaeschna janata			-99
Calopteryx			1
Enallagma		1	20
Gomphidae		5	
Hetaerina			1
Macromia			-99
PLECOPTERA			
Neoperla	10	3	
RHYNCHOBDELLIDA			
Glossiphoniidae		1	
TRICHOPTERA			
Cheumatopsyche	8		1
Chimarra	6		
Helicopsyche	13		2
Marilia	2		
Nectopsyche diarina		1	
Nyctiophylax		1	
Oecetis	1	1	17
Polycentropus		3	
Pycnopsyche			-99

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14935], Station #2b, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Triaenodes			16
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Aulodrilus		5	2
Branchiura sowerbyi		2	
Limnodrilus hoffmeisteri		1	1
Tubificidae		4	2
VENEROIDA			
Corbicula	21	14	1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14934], Station #2a, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	14	24
AMPHIPODA			
Hyaella azteca			27
BASOMMATOPHORA			
Ancylidae	4	5	2
Menetus			7
COLEOPTERA			
Ancyronyx variegatus			2
Berosus			1
Dubiraphia		12	15
Ectopria nervosa		1	1
Lutrochus	2		
Macronychus glabratus		1	7
Microcylloepus pusillus	2	1	9
Psephenus herricki	16	-99	
Stenelmis	22	38	1
DECAPODA			
Orconectes luteus	1		
Orconectes punctimanus			1
DIPTERA			
Ablabesmyia		18	5
Ceratopogoninae		8	1
Chironomidae		1	
Chironomus			1
Cladopelma		2	
Cladotanytarsus		9	1
Cricotopus bicinctus		1	
Cricotopus/Orthocladius	6	1	13
Cryptochironomus		4	
Cryptotendipes			1
Dicrotendipes	3	16	1
Dixella			1
Forcipomyiinae		1	
Hemerodromia	6		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14934], Station #2a, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hexatoma	5	1	
Labrundinia		3	10
Nilotanypus	1	1	
Parakiefferiella			5
Paratanytarsus	1	17	14
Paratendipes		2	
Pentaneura			1
Polypedilum flavum	8		
Polypedilum halterale grp		2	
Polypedilum illinoense grp		1	
Pseudochironomus		2	6
Rheotanytarsus	13		2
Simuliidae	1		
Stempellinella		5	2
Stenochironomus	3	1	3
Tanytarsus	1	23	12
Thienemanniella	2		
Thienemannimyia grp.	15		1
Tribelos		2	1
Xenochironomus			1
EPHEMEROPTERA			
Anthopotamus		2	
Baetis	4		
Baetiscidae		1	
Caenis anceps	107	79	14
Caenis latipennis	2	26	21
Choroterpes		11	
Ephemera simulans		-99	
Isonychia bicolor	17		
Leptophlebiidae		4	1
Maccaffertium bednariki	16		
Maccaffertium mediopunctatum	39		
Maccaffertium pulchellum	2		
Procloeon		3	
Stenonema femoratum		3	1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14934], Station #2a, Sample Date: 9/16/2014 1:35:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tricorythodes	332	1	
LUMBRICINA			
Lumbricina	8	2	2
MEGALOPTERA			
Corydalus	7		
Sialis			1
ODONATA			
Argia	1	5	5
Enallagma			26
Gomphidae	2		1
Hagenius brevistylus	1		
Macromia	2		-99
PLECOPTERA			
Neoperla	24		
TRICHOPTERA			
Cheumatopsyche	3		
Chimarra	16		
Helicopsyche	16	1	
Leptoceridae	1		1
Marilia	5		
Nectopsyche diarina		1	
Nyctiophylax		2	
Oecetis		3	12
Polycentropus		1	
Pycnopsyche			-99
Triaenodes			13
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Aulodrilus		1	
Tubificidae		2	1
VENEROIDA			
Corbicula	11	13	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14933], Station #3, Sample Date: 9/16/2014 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	18	34
AMPHIPODA			
Hyaella azteca			14
BASOMMATOPHORA			
Ancylidae	2	4	6
Helisoma			1
Menetus			37
Physella			2
COLEOPTERA			
Berosus			1
Dubiraphia		12	18
Ectopria nervosa	1	1	
Helichus lithophilus			3
Microcylloepus pusillus	1		25
Optioservus sandersoni	1		
Psephenus herricki	9	4	
Scirtidae			2
Stenelmis	30	97	2
DECAPODA			
Orconectes luteus	-99		
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		2	
Ceratopogoninae		7	2
Chironomidae		1	2
Cladopelma		2	
Cladotanytarsus		11	
Clinotanypus			1
Corynoneura	1		
Cricotopus/Orthocladius	8	2	11
Cryptochironomus		4	
Cryptotendipes		3	
Dicrotendipes	2	13	3
Dixella			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14933], Station #3, Sample Date: 9/16/2014 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hemerodromia	1	1	
Hexatoma	4	2	
Labrundinia		3	7
Larsia		1	1
Microtendipes	1		
Nanocladius		1	
Nilotanypus			3
Nilothauma		1	
Paracladopelma		1	
Parakiefferiella		3	
Paralauterborniella		2	
Paratanytarsus		3	16
Phaenopsectra		5	
Polypedilum fallax grp			1
Polypedilum flavum	9		
Polypedilum illinoense grp			2
Polypedilum scalaenum grp		2	
Procladius		5	
Pseudochironomus		3	
Rheotanytarsus	6		4
Stempellina		1	
Stempellinella		9	2
Stictochironomus		1	
Tabanus	-99		
Tanytarsus	2	13	9
Thienemanniella		1	
Thienemannimyia grp.	4		1
EPHEMEROPTERA			
Acerpenna	-99		
Anthopotamus		2	
Baetis	6		
Caenis anceps	135		
Caenis latipennis	11	125	
Choroterpes		7	
Ephemera simulans		-99	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14933], Station #3, Sample Date: 9/16/2014 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ephemerellidae			2
Hexagenia limbata		-99	
Isonychia bicolor	30		
Leptophlebiidae	1	3	1
Leucrocuta	11		
Maccaffertium bednariki	6		
Maccaffertium mediopunctatum	33		
Maccaffertium pulchellum	10		
Procloeon		9	1
Stenacron		2	1
Stenonema femoratum	-99	9	
Tricorythodes	300		17
HEMIPTERA			
Rheumatobates		2	
LEPIDOPTERA			
Petrophila	1		
LUMBRICINA			
Lumbricina	4		-99
MEGALOPTERA			
Corydalus	3		
Sialis		1	
ODONATA			
Argia	-99		35
Basiaeschna janata			-99
Dromogomphus			-99
Enallagma		1	21
Gomphidae		2	
Gomphus		-99	
Hagenius brevistylus		1	
Hetaerina			1
Macromia			1
Stylogomphus albistylus			-99
PLECOPTERA			
Leuctra	1		
Neoperla	15		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14933], Station #3, Sample Date: 9/16/2014 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICHOPTERA			
Ceratopsyche morosa grp	1		
Cheumatopsyche	21		
Chimarra	8		
Helicopsyche	25	1	2
Hydroptila			2
Marilia	7		3
Oecetis	2		11
Pycnopsyche			-99
Triaenodes			26
TRICLADIDA			
Planariidae	1		1
TUBIFICIDA			
Aulodrilus		1	3
Branchiura sowerbyi		4	
Tubificidae		2	2
VENEROIDA			
Corbicula	-99	12	1
Pisidiidae	3		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14932], Station #4, Sample Date: 9/15/2014 3:55:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	46	19	4
AMPHIPODA			
Hyaella azteca			24
BASOMMATOPHORA			
Ancylidae	4	9	8
Helisoma			-99
Menetus		2	5
Physella		1	
COLEOPTERA			
Berosus		-99	
Dubiraphia		2	62
Dytiscidae		1	
Helichus basalis			2
Helichus lithophilus	-99		
Lutrochus		1	
Macronychus glabratus			32
Microcylloepus pusillus	6	1	5
Optioservus sandersoni			22
Psephenus herricki	14	4	
Scirtidae			1
Stenelmis	28	38	3
DECAPODA			
Orconectes luteus	-99		-99
Orconectes virilis	-99		-99
DIPTERA			
Ablabesmyia		10	10
Ceratopogoninae	1	2	1
Chironomidae		2	3
Chironomus		2	
Cladotanytarsus		5	
Clinotanypus			3
Corynoneura		4	1
Cricotopus/Orthocladius	16		2
Cryptochironomus			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14932], Station #4, Sample Date: 9/15/2014 3:55:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cryptotendipes		1	
Dasyheleinae		1	
Dicrotendipes		23	5
Dixella			1
Forcipomyiinae	1	2	
Hemerodromia	8		2
Hexatoma	1	1	
Labrundinia		7	22
Nanocladius	2		
Natarsia	1		
Nilotanypus			1
Nilothauma		2	
Paralauterborniella		2	1
Paratanytarsus	1	12	29
Paratendipes		2	
Phaenopsectra		24	
Polypedilum fallax grp			1
Polypedilum flavum	16		
Polypedilum illinoense grp	1		5
Polypedilum scalaenum grp		2	
Procladius		2	
Pseudochironomus		1	
Rheotanytarsus	44		5
Simulium	1		
Stempellina		3	
Stempellinella	1	4	1
Tabanus	-99		
Tanytarsus	3	35	13
Thienemanniella	3	1	
Thienemannimyia grp.	3	2	5
Tribelos			2
Zavrelimyia			2
EPHEMEROPTERA			
Anthopotamus		-99	
Baetis	18		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14932], Station #4, Sample Date: 9/15/2014 3:55:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Caenis anceps	159	18	7
Caenis latipennis	4	14	18
Choroterpes		1	1
Ephemerellidae		1	1
Hexagenia limbata		-99	
Isonychia bicolor	10		
Leptophlebiidae		6	2
Maccaffertium mediopunctatum	19		
Maccaffertium pulchellum	12		
Procloeon		1	1
Stenonema femoratum	1	3	
Tricorythodes	327	2	10
HEMIPTERA			
Microvelia			1
ISOPODA			
Lirceus	2	2	2
LUMBRICINA			
Lumbricina	3	-99	
MEGALOPTERA			
Corydalus	6		
Sialis		-99	
ODONATA			
Argia	2	2	9
Calopteryx			1
Enallagma			5
Gomphidae		-99	
Hagenius brevistylus		1	-99
Hetaerina			5
Stylogomphus albistylus			1
PLECOPTERA			
Leuctra	4		
Neoperla	23	4	
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14932], Station #4, Sample Date: 9/15/2014 3:55:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	34		
Chimarra	11		
Helicopsyche	26	4	1
Hydroptila	1	3	1
Hydroptilidae			1
Leptoceridae		2	2
Marilia	9		
Oecetis	9	1	22
Oxyethira			1
Pycnopsyche			-99
Triaenodes			31
TRICLADIDA			
Planariidae	3		4
TUBIFICIDA			
Aulodrilus		3	2
Branchiura sowerbyi		3	1
Limnodrilus hoffmeisteri		2	1
Tubificidae	1	1	8
VENEROIDA			
Pisidiidae			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14931], Station #5, Sample Date: 9/15/2014 1:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	14	5	1
AMPHIPODA			
Hyaella azteca			82
BASOMMATOPHORA			
Ancylidae	4	4	2
Helisoma			-99
Menetus			1
Physella		1	3
COLEOPTERA			
Berosus	1	1	
Dubiraphia		9	17
Ectopria nervosa	1		
Macronychus glabratus			3
Microcylloepus pusillus	5		61
Optioservus sandersoni	3		
Psephenus herricki	65	4	1
Stenelmis	57	155	6
DECAPODA			
Orconectes luteus	2		-99
Orconectes virilis			1
DIPTERA			
Ablabesmyia		11	2
Cardiocladius	1		
Cladotanytarsus		4	1
Corynoneura	1		
Cricotopus/Orthocladius	8	2	6
Cryptochironomus		6	
Dicrotendipes		18	4
Forcipomyiinae	2		
Hemerodromia	5	1	1
Hexatoma	4	1	
Labrundinia		2	10
Nilotanypus			2
Parachironomus			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14931], Station #5, Sample Date: 9/15/2014 1:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paralauterborniella		1	1
Paratanytarsus		1	24
Phaenopsectra		17	
Polypedilum flavum	61		
Polypedilum illinoense grp	1		6
Polypedilum scalaenum grp		11	
Pseudochironomus		1	
Rheotanytarsus	20		5
Simulium	3		
Stempellinella		4	1
Stenochironomus	1		
Tabanus	1		
Tanytarsus	2	5	6
Thienemanniella	7		
Thienemannimyia grp.	3	4	5
Zavreliomyia			1
EPHEMEROPTERA			
Anthopotamus		1	
Baetis	129		
Caenis anceps	148	42	9
Caenis latipennis	3	4	3
Callibaetis			1
Choroterpes		10	1
Heptageniidae	17	2	
Isonychia bicolor	38		
Leucrocuta	6		
Maccaffertium mediopunctatum	25		
Maccaffertium pulchellum	51		
Paracloeodes			1
Procloeon		6	
Stenacron		2	
Stenonema femoratum		15	3
Tricorythodes	103	13	5
LEPIDOPTERA			
Petrophila		1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [14931], Station #5, Sample Date: 9/15/2014 1:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
LUMBRICINA			
Lumbricina	16		1
MEGALOPTERA			
Corydalus	4		
ODONATA			
Argia	4	4	30
Calopteryx			1
Enallagma			11
Hetaerina			2
PLECOPTERA			
Neoperla	21	1	
TRICHOPTERA			
Ceratopsyche morosa grp	5		
Cheumatopsyche	103		1
Chimarra	13		
Helicopsyche	31	5	1
Hydroptila	1		
Marilia	18		
Oecetis	11	5	7
Triaenodes			44
TRICLADIDA			
Planariidae	5		
TUBIFICIDA			
Enchytraeidae	6		
Tubificidae		3	
VENEROIDA			
Pisidiidae		1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15098], Station #1a, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	11	30	
AMPHIPODA			
Gammarus			-99
Hyalella azteca	1	1	6
BASOMMATOPHORA			
Lymnaeidae	1		1
BRANCHIOBDELLIDA			
Branchiobdellida		4	
COLEOPTERA			
Berosus		1	-99
Dubiraphia		1	1
Dytiscidae			-99
Helichus lithophilus			1
Microcylloepus pusillus		1	2
Psephenus herricki	1		-99
Stenelmis	50	42	1
DECAPODA			
Orconectes luteus		-99	
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		2	2
Ceratopogoninae	4	3	
Chironomidae		3	
Cladotanytarsus		9	1
Clinocera	2		
Corynoneura		2	20
Cricotopus bicinctus			1
Cricotopus/Orthocladius	8	4	29
Cryptochironomus		2	
Dicrotendipes		2	1
Eukiefferiella	3		
Hemerodromia	1	1	3
Hexatoma	120	24	-99
Hydrobaenus		3	1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15098], Station #1a, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Labrundinia			11
Nilotanypus			1
Nilothauma		1	
Ormosia	2		
Orthocladius (Euorthocladius)	1		
Parametriocnemus	7	1	2
Paratanytarsus		4	23
Paratendipes		2	
Phaenopsectra		10	1
Polypedilum aviceps	5		1
Polypedilum flavum	3		
Polypedilum illinoense grp			2
Polypedilum laetum		4	
Polypedilum scalaenum grp		2	
Prosimulium	18		
Psectrocladius	1		
Rheotanytarsus		2	6
Simulium	16		
Stempellinella		3	2
Stictochironomus		2	
Symptothastia	1	5	14
Tabanus	10	2	
Tanytarsus		8	11
Thienemanniella	3	1	15
Thienemannimyia grp.		5	12
Tvetenia bavarica grp	1		1
Zavreliomyia			1
EPHEMEROPTERA			
Acentrella	10		
Acerpenna	3		
Anthopotamus		2	-99
Baetisca lacustris		-99	1
Caenis anceps	4	10	18
Caenis latipennis	15	20	64
Centroptilum			1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15098], Station #1a, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ephemera simulans		-99	-99
Eurylophella bicolor			1
Heptageniidae	2		
Isonychia bicolor	8		2
Leptophlebia			-99
Maccaffertium bednariki	10	1	
Maccaffertium mediopunctatum	15	1	2
Maccaffertium pulchellum	9	7	4
Serratella frisoni	1		
Stenacron		1	
Stenonema femoratum	-99	3	5
Tricorythodes	45	27	11
HAPLOTAXIDA			
Haplotaxis	1		
LEPIDOPTERA			
Petrophila		-99	
LUMBRICINA			
Lumbricina	28		-99
MEGALOPTERA			
Corydalus	3		-99
ODONATA			
Argia		1	
Basiaeschna janata			-99
Dromogomphus		2	-99
Enallagma			5
Hagenius brevistylus		1	-99
Macromia			-99
PLECOPTERA			
Isoperla	100		1
Neoperla	9	1	
Perlesta	25		4
Perlinella ephyre	9	1	
Prostoia	9		1
TRICHOPTERA			
Agapetus	10	3	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15098], Station #1a, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	6	2	1
Chimarra	43		2
Helicopsyche	3		
Hydroptila		10	
Ironoquia			1
Oecetis		2	
Polycentropus	1	-99	-99
Pycnopsyche			-99
Trienodes			2
TUBIFICIDA			
Aulodrilus		3	
Branchiura sowerbyi		6	
Enchytraeidae	1	4	1
Limnodrilus hoffmeisteri		1	
Tubificidae		2	
VENEROIDA			
Corbicula	-99		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15099], Station #1b, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	40	16	3
AMPHIPODA			
Crangonyx		1	
Gammarus			3
Hyalella azteca		6	12
BASOMMATOPHORA			
Menetus	1		
COLEOPTERA			
Ancyronyx variegatus		1	
Berosus		1	1
Dineutus			1
Dubiraphia		9	2
Helichus basalis			1
Helichus lithophilus			2
Hydraena	1		
Microcylloepus pusillus		1	2
Psephenus herricki	1	2	
Stenelmis	53	8	
DECAPODA			
Orconectes luteus			-99
Orconectes punctimanus			1
DIPTERA			
Ablabesmyia		11	7
Ceratopogoninae	14	6	
Chironomidae	2	1	
Chironomus		2	
Cladotanytarsus		3	
Clinocera			1
Corynoneura		3	11
Cricotopus bicinctus			2
Cricotopus/Orthocladius	4	14	48
Cryptochironomus		1	
Dicrotendipes		4	
Empididae		1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15099], Station #1b, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Gonomyia	2		
Hemerodromia	2	1	2
Hexatoma	126	6	1
Hydrobaenus		2	1
Labrundinia		4	6
Micropsectra			1
Microtendipes		1	
Nanocladius			1
Natarsia			1
Ormosia		1	
Parametriocnemus	13	3	
Paratanytarsus		13	30
Paratendipes		1	
Phaenopsectra		9	2
Polypedilum aviceps			2
Polypedilum flavum	1		
Polypedilum halterale grp		2	
Polypedilum illinoense grp			2
Polypedilum scalaenum grp		1	
Prosimulium	12		
Pseudochironomus		1	
Rheocricotopus			2
Rheotanytarsus		10	10
Simulium	7	1	
Stempellinella		1	4
Sympothastia		9	5
Tabanus	1		
Tanytarsus		7	6
Thienemanniella		3	11
Thienemannimyia grp.		3	15
Tvetenia			1
Zavrelimyia			1
EPHEMEROPTERA			
Acentrella	6	1	
Anthopotamus		2	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15099], Station #1b, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Caenis anceps	4	17	11
Caenis latipennis	17	53	106
Eurylophella		2	3
Isonychia bicolor	8		
Leptophlebiidae			1
Maccaffertium bednariki	14	1	
Maccaffertium mediopunctatum	10		
Maccaffertium pulchellum	10	7	2
Maccaffertium terminatum	3	2	
Stenonema femoratum	1	5	4
Tricorythodes	52	15	7
LUMBRICINA			
Lumbricina	20	4	
MEGALOPTERA			
Corydalus	-99		
ODONATA			
Argia		2	2
Dromogomphus			-99
Enallagma		1	2
Gomphidae		1	
Hetaerina			1
Macromia			-99
PLECOPTERA			
Amphinemura	2		
Chloroperlidae	1		
Isoperla	77		1
Neoperla	19		
Perlesta	25	2	5
Perlinella ephyre	4		
Prostoia	3		1
TRICHOPTERA			
Cheumatopsyche	5		1
Chimarra	44		
Glossosomatidae	10	3	
Helicopsyche	6	1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15099], Station #1b, Sample Date: 3/23/2015 12:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hydroptila	1	5	3
Nectopsyche			1
Oecetis			1
Polycentropus	1		-99
Pycnopsyche			2
Triaenodes		1	3
TUBIFICIDA			
Branchiura sowerbyi		5	
Enchytraeidae	1	9	1
Tubificidae	2	4	
VENEROIDA			
Corbicula	2		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15100], Station #2, Sample Date: 3/23/2015 3:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	32	33	6
AMPHIPODA			
Crangonyx			-99
Hyalella azteca			25
BASOMMATOPHORA			
Ancylidae	3	1	1
Helisoma			-99
Lymnaeidae	3		
Menetus	1		1
Physella	-99		
COLEOPTERA			
Berosus		1	
Dubiraphia	1	10	
Microcylloepus pusillus	1	1	1
Optioservus sandersoni		1	
Psephenus herricki	10	1	1
Stenelmis	25	39	2
DECAPODA			
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		6	11
Cardiocladius	2		
Ceratopogoninae	3	7	
Chironomidae		1	
Chironomus		9	
Cladotanytarsus	2		
Clinocera	2		
Corynoneura	2	1	17
Cricotopus bicinctus			3
Cricotopus/Orthocladius	15	3	53
Cryptochironomus	1	8	1
Diamesa	3		
Dicrotendipes		9	3
Diptera		1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15100], Station #2, Sample Date: 3/23/2015 3:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Dixella			1
Eukiefferiella	3		
Forcipomyiinae		1	
Hemerodromia	12	1	3
Hexatoma	5	1	
Hydrobaenus		2	
Labrundinia			5
Limonia	1		
Microtendipes	1	1	
Natarsia		1	
Orthocladius (Euorthocladius)	2		2
Paracladopelma		1	
Paralauterborniella		7	
Parametriocnemus	6	2	1
Paratanytarsus		8	42
Paratendipes	1	1	
Phaenopsectra		23	1
Polypedilum fallax grp			1
Polypedilum flavum	7		
Polypedilum halterale grp	1		
Polypedilum illinoense grp			4
Polypedilum scalaenum grp		1	
Procladius		4	
Prosimulium	2		
Pseudochironomus	3	2	1
Rheocricotopus	1		
Rheotanytarsus	3		4
Simulium	2		1
Smittia		1	
Stempellinella	24	5	11
Stenochironomus			1
Stictochironomus		1	
Sympothastia	7	5	56
Tabanus	1		
Tanytarsus	3	22	12

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15100], Station #2, Sample Date: 3/23/2015 3:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemanniella	2	1	14
Thienemannimyia grp.	4	3	6
Tipula	-99		-99
Tribelos		7	
Tvetenia bavarica grp			1
EPHEMEROPTERA			
Acentrella	4		
Acerpenna	1		
Anthopotamus	-99		
Caenis latipennis	58	57	47
Ephemera simulans	-99	1	
Ephemerella invaria	3		
Eurylophella enoensis			1
Hexagenia limbata		-99	
Isonychia bicolor	26		
Leptophlebia			-99
Maccaffertium bednariki	8	1	
Maccaffertium mediopunctatum	19		
Maccaffertium pulchellum	9		1
Maccaffertium terminatum	8		
Stenacron	3	1	
Stenonema femoratum	21	4	7
Tricorythodes	60	3	9
HAPLOTAXIDA			
Haplotaxis		1	
LUMBRICINA			
Lumbricina	11		
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	4		
Basiaeschna janata			-99
Dromogomphus			-99
Enallagma			7
PLECOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15100], Station #2, Sample Date: 3/23/2015 3:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Allocaenia	1		
Amphinemura	1		
Chloroperlidae	4		
Clioperla clio			-99
Isoperla	28		
Neoperla	13	1	
Perlesta	13		4
Prostoia	1		
TRICHOPTERA			
Cheumatopsyche	3		
Chimarra	7		
Helicopsyche	55	2	
Hydropsyche	3		
Hydroptila	6		1
Lepidostoma	1		
Marilia	2		
Mystacides	1		
Nectopsyche diarina			1
Nectopsyche pavidia		1	
Neophylax	-99		
Oecetis	1		1
Polycentropus	-99	4	
Pycnopsyche			2
Rhyacophila	1		
Wormaldia	1		
TRICLADIDA			
Planariidae	4		1
TUBIFICIDA			
Branchiura sowerbyi		4	
Limnodrilus hoffmeisteri		1	
Tubificidae		14	
VENEROIDA			
Corbicula	13		1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15101], Station #3, Sample Date: 3/24/2015 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	55	53	6
AMPHIPODA			
Hyaella azteca			12
BASOMMATOPHORA			
Ancylidae	6	2	
Helisoma			1
Menetus			3
BRANCHIOBDELLIDA			
Branchiobdellida		2	
COLEOPTERA			
Berosus			-99
Dubiraphia		9	11
Helichus lithophilus			2
Microcylloepus pusillus		1	5
Psephenus herricki	10	1	1
Stenelmis	51	4	3
DECAPODA			
Orconectes luteus		-99	
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		3	5
Cardiocladius	2		
Ceratopogoninae	11	33	
Chironomidae	1	4	1
Chironomus		3	
Cladotanytarsus	1	25	
Clinotanytus			1
Corynoneura	1	6	5
Cricotopus bicinctus	2		2
Cricotopus/Orthocladius	34	15	32
Cryptochironomus		3	
Diamesa	1		
Dicrotendipes	2	8	3
Empididae		1	

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15101], Station #3, Sample Date: 3/24/2015 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Eukiefferiella	5		
Forcipomyiinae		1	
Hemerodromia	12		
Hexatoma	20	1	
Labrundinia		4	6
Microtendipes	3		
Nanocladius	2		2
Paracladopelma		2	
Paralauterborniella		6	
Parametriocnemus	19		
Paratanytarsus		11	82
Paratendipes		4	
Phaenopsectra		8	1
Polypedilum aviceps	1		
Polypedilum flavum	8		
Polypedilum halterale grp		3	
Polypedilum illinoense grp	1	4	1
Polypedilum scalaenum grp	1	11	
Procladius		1	
Prosimulium	1		
Pseudochironomus		1	
Rheocricotopus	3		
Rheotanytarsus	3		3
Simulium	6		
Stempellinella	6	45	8
Stictochironomus		2	
Sympotthastia	16	2	3
Tabanus	1		
Tanytarsus	11	27	7
Thienemanniella	2	1	
Thienemannimyia grp.	8	3	4
Tipula	-99		-99
Tribelos		1	
Tvetenia bavarica grp	1		

EPHEMEROPTERA

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15101], Station #3, Sample Date: 3/24/2015 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Acentrella	5		
Anthopotamus	-99		
Caenis anceps	33	31	16
Caenis latipennis	30	32	37
Centropilum			1
Ephemerella invaria	2		
Eurylophella bicolor	2	2	5
Heptageniidae	10		
Hexagenia limbata		-99	
Isonychia bicolor	12		
Leptophlebiidae			5
Maccaffertium bednariki	14		
Maccaffertium mediopunctatum	10		
Maccaffertium pulchellum	5		
Stenacron	4	2	
Stenonema femoratum	6	8	2
Tricorythodes	84		13
GORDIOIDEA			
Chordodidae	-99		
HEMIPTERA			
Belostoma			-99
ISOPODA			
Lirceus			1
LUMBRICINA			
Lumbricina	8		
MEGALOPTERA			
Corydalus	2		
Sialis		-99	
ODONATA			
Argia			10
Calopteryx			2
Dromogomphus		-99	
Enallagma		2	5
Gomphidae	2		
Hagenius brevistylus			-99

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15101], Station #3, Sample Date: 3/24/2015 8:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hetaerina		1	
Macromia			-99
PLECOPTERA			
Amphinemura	4		
Haploperla	1		
Isoperla	21		
Neoperla	35		
Perlesta	16		2
Prostoia	3		
TRICHOPTERA			
Ceratopsyche morosa grp	1		
Cheumatopsyche	2		-99
Chimarra	8		
Helicopsyche	23	2	3
Hydroptila	5	1	4
Marilia	3		
Mystacides		1	
Nectopsyche	1	1	2
Oecetis	3	1	3
Orthotrichia	1		
Pycnopsyche	1		1
Triaenodes			8
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Branchiura sowerbyi		1	
Limnodrilus hoffmeisteri		2	
Tubificidae		15	1
VENEROIDA			
Corbicula	3	1	1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15102], Station #4, Sample Date: 3/24/2015 10:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	15	59	
AMPHIPODA			
Crangonyx	4		3
Hyalella azteca			12
BASOMMATOPHORA			
Ancylidae	2	1	1
Helisoma	1		
Lymnaeidae	1	1	
Menetus	2		1
COLEOPTERA			
Ancyronyx variegatus	2		
Dubiraphia		10	4
Helichus basalis			1
Helichus lithophilus			2
Microcylloepus pusillus	21		17
Psephenus herricki	6		3
Stenelmis	61	11	2
DECAPODA			
Orconectes luteus	1	-99	-99
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		6	2
Cardiocladius	1		
Ceratopogoninae	1	10	1
Chironomidae		3	
Chironomus		1	
Chrysops		-99	
Cladotanytarsus		15	
Clinocera	7		
Clinotanypus			1
Corynoneura		4	10
Cricotopus bicinctus	2		6
Cricotopus/Orthocladius	24	9	43
Cryptochironomus	1	6	2

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15102], Station #4, Sample Date: 3/24/2015 10:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cryptotendipes		1	
Diamesa	1		
Dicrotendipes		7	3
Diptera		1	
Eukiefferiella	4	1	
Hemerodromia	12		2
Hexatoma	2	1	
Hydrobaenus		1	
Labrundinia		1	3
Microtendipes			1
Nanocladius		1	5
Orthocladius (Euorthocladius)	4		
Parakiefferiella		1	
Paralauterborniella		5	1
Parametriocnemus	7		2
Paraphaenocladius			1
Paratanytarsus	2	3	46
Paratendipes		7	1
Phaenopsectra		13	1
Polypedilum aviceps	3		1
Polypedilum flavum	8	1	1
Polypedilum halterale grp		1	
Polypedilum illinoense grp	2		1
Polypedilum scalaenum grp		7	
Procladius		1	
Prosimulium	7		
Rheocricotopus			2
Rheotanytarsus	4	1	10
Simulium	3		
Stempellinella	10	18	10
Stictochironomus		1	
Symptothastia	20		16
Tabanus	-99		
Tanytarsus	1	22	22
Thienemanniella	7	4	10

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15102], Station #4, Sample Date: 3/24/2015 10:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.	3	6	11
Tipula	2	-99	-99
Tribelos		1	
EPHEMEROPTERA			
Acentrella	10		
Acerpenna	1		
Anthopotamus		3	
Caenis anceps	12	19	21
Caenis latipennis	17	10	31
Ephemerella invaria	5		1
Eurylophella	1		
Eurylophella enoensis			2
Heptageniidae	5	1	
Isonychia bicolor	12		
Leptophlebia			1
Maccaffertium bednariki	2		
Maccaffertium mediopunctatum	21		
Maccaffertium pulchellum	15	2	1
Serratella serratoides	2		1
Stenacron		3	1
Stenonema femoratum	6	34	4
Tricorythodes	35	4	8
ISOPODA			
Caecidotea	6	2	
Lirceus	2		9
LUMBRICINA			
Lumbricina	21	1	
MEGALOPTERA			
Corydalus	3		
ODONATA			
Argia		-99	1
Enallagma		1	1
Gomphidae			1
Gomphus			-99
Stylogomphus albistylus	1		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15102], Station #4, Sample Date: 3/24/2015 10:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
PLECOPTERA			
Acroneuria		-99	
Alloperla	2		
Amphinemura	7		1
Isoperla	60		
Neoperla	36	2	
Perlesta	12	1	10
Prostoia	4		
TRICHOPTERA			
Cheumatopsyche	13		2
Chimarra	3	1	
Helicopsyche	19	1	2
Hydroptila	3	1	3
Oecetis			2
Pycnopsyche	2		2
Triaenodes			2
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Aulodrilus		3	
Branchiura sowerbyi		2	
Limnodrilus hoffmeisteri		2	1
Tubificidae		10	2
VENEROIDA			
Corbicula	1		

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15103], Station #5, Sample Date: 3/24/2015 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	22	23	13
AMPHIPODA			
Crangonyx		1	4
Gammarus			-99
Hyalella azteca			13
BASOMMATOPHORA			
Ancylidae	1		1
Helisoma			1
Physella			2
BRANCHIOBELLELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	1	5	2
Hydraena			1
Microcylloepus pusillus	1		11
Psephenus herricki	21	2	
Stenelmis	24	36	2
DECAPODA			
Orconectes luteus	-99	-99	-99
DIPTERA			
Ablabesmyia		9	1
Cardiocladius	1		
Ceratopogoninae		3	
Chaetocladius		1	
Chironomidae		1	
Cladotanytarsus	2		
Clinocera	7		
Corynoneura	1	5	4
Cricotopus bicinctus			3
Cricotopus/Orthocladius	18	8	22
Cryptochironomus		2	1
Dasyheleinae			1
Diamesa	1		
Dicrotendipes		6	2

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15103], Station #5, Sample Date: 3/24/2015 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Eukiefferiella	4		
Hemerodromia	13		1
Hexatoma	1		1
Labrundinia			6
Microtendipes		1	
Molophilus	1		
Orthocladius (Euorthocladius)	1		2
Paracladopelma		1	
Paralauterborniella		1	
Parametriocnemus	16		
Paratanytarsus	2	1	15
Paratendipes		2	
Phaenopsectra		5	
Polypedilum aviceps	8		1
Polypedilum flavum	14		1
Polypedilum illinoense grp		1	1
Polypedilum scalaenum grp		1	
Prosimulium	12		2
Pseudochironomus		1	1
Rheocricotopus	5		8
Rheotanytarsus	2		7
Stempellinella	6	7	2
Stenochironomus		1	
Sympotthastia	6	1	7
Tabanus	2		-99
Tanytarsus	2	3	1
Thienemanniella	1		6
Thienemannimyia grp.	14	4	5
Tipula	-99		-99
Zavreliomyia		1	
EPHEMEROPTERA			
Acentrella	12		1
Acerpenna	2		
Caenis anceps	32	61	2
Caenis latipennis	38	21	29

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15103], Station #5, Sample Date: 3/24/2015 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ephemerella invaria	20		
Eurylophella bicolor	2		2
Isonychia bicolor	54	1	5
Leptophlebia		4	1
Maccaffertium mediopunctatum	23		1
Maccaffertium pulchellum	66	3	6
Serratella serratoides	1		2
Stenacron		12	
Stenonema femoratum	33	53	2
Tricorythodes	64	2	15
ISOPODA			
Lirceus	10	5	21
LEPIDOPTERA			
Petrophila	1		
LUMBRICINA			
Lumbricina	12	2	
MEGALOPTERA			
Corydalus	4		-99
ODONATA			
Argia	1	3	4
Boyeria			-99
Calopteryx			1
Enallagma			1
Stylogomphus albistylus			-99
PLECOPTERA			
Acroneuria	-99		
Amphinemura	8		
Chloroperlidae	3		
Isoperla	34		
Neoperla	34	1	
Perlesta	12		5
Prostoia	3		1
TRICHOPTERA			
Ceraclea	1		
Ceratopsyche morosa grp	3		1

Aquid Invertebrate Database Bench Sheet Report

Little Whitewater Cr [15103], Station #5, Sample Date: 3/24/2015 11:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	57		8
Chimarra	8		
Helicopsyche	42	1	19
Hydropsyche	-99		
Hydroptila	7		4
Marilia	4		1
Neophylax	1		1
Oecetis	1		5
Polycentropus	2		
Pycnopsyche		-99	-99
Triaenodes			6
TRICLADIDA			
Planariidae	6	1	1
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae	1		
Limnodrilus hoffmeisteri		1	
Tubificidae	1	2	